HEAT INSULATION FOR TEMPERATURES 500°F. TO 1200°F.

BULLETIN 101A

Carey
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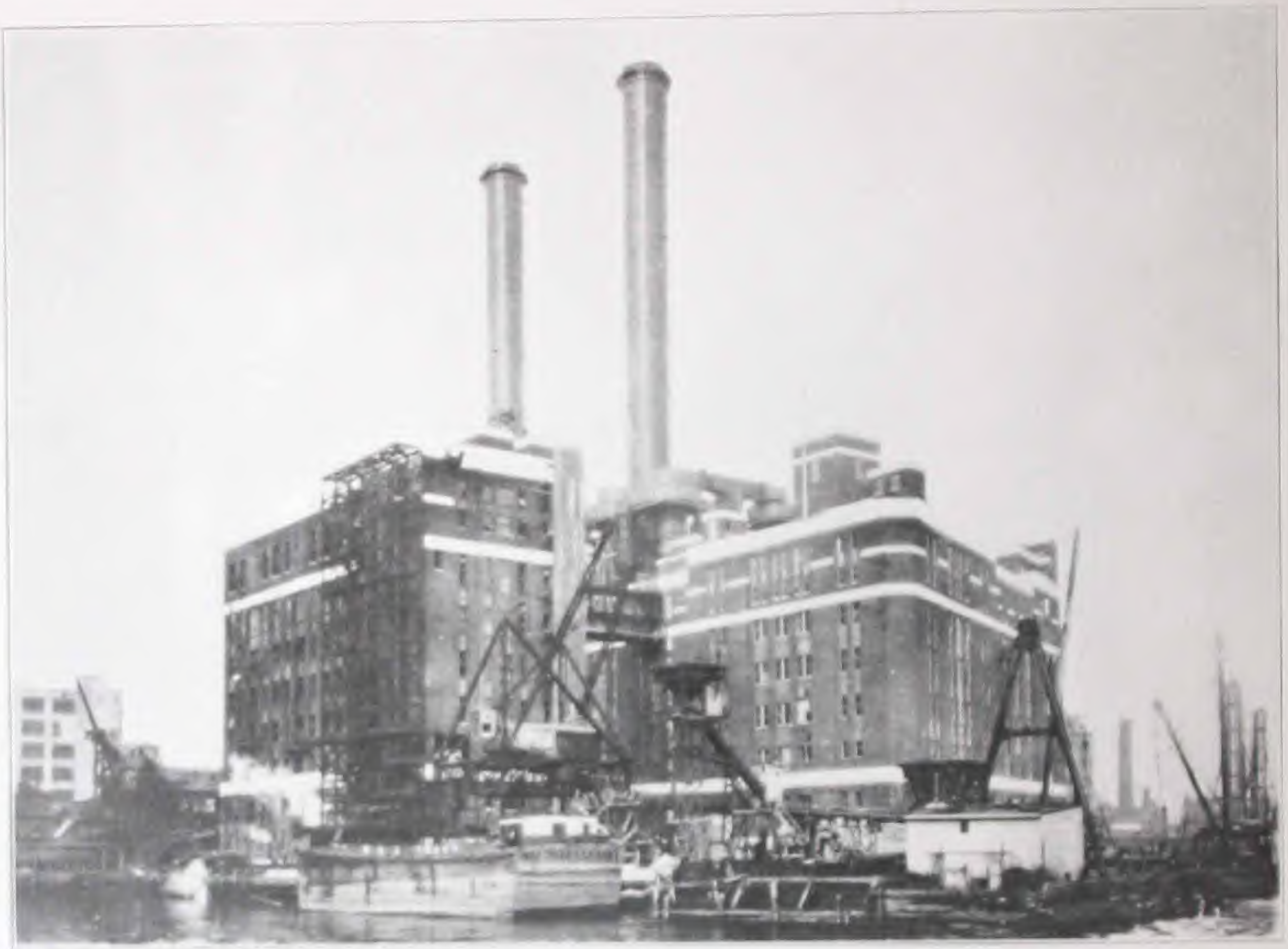
EST. 1873

THE PHILIP CAREY COMPANY
CINCINNATI, OHIO



East River Station of the New York Edison Company—Thomas E. Murray, Inc., Engineers. All super-heated steam piping is insulated with Carey Hi-Temp No. 12 and Carey 85% Magnesia.

BULLETIN 101A

THE PHILIP CAREY COMPANY

CINCINNATI, OHIO

THIS bulletin deals with High Temperature Insulation, and, like other Carey bulletins discussing various phases of heat conservation, has been prepared to meet the growing demand of engineers for reliable information on the subject.

Engineers and plant operating executives are realizing more and more the close connection between suitable heat insulation and plant operating costs, maintenance charges and net profits.

For this is an age of keen industrial competition. Growth and success demand utmost economy of production.

Carey Heat Insulation, it definitely has been shown, will contribute towards this achievement.

The high temperatures experienced in superheated steam, in oil refining practice, and in many industrial processes result in correspondingly large heat losses from bare metal surfaces. The amount of these losses is seldom fully appreciated.

For example, a bare 12″ pipe at 750° F. with an average air temperature of 80° F. will dissipate 120,880,000 B. T. U.'s per lineal foot per year. At a fuel cost of $0.30 per million B. T. U.'s, which is a conservative figure, the annual loss *from one foot* of such pipe is $36.27.

A suitable 4″ thick insulation, which will save approximately 97% of this loss, costs only about $6.00 per lineal foot in place; that is, installed on the pipe. It is evident that a careful selection of insulation, both as to kind and thickness, is required.

Relations between cost of heat, cost of insulation, savings, and time required for savings to repay the original cost of the insulation for one combination of materials are given in tables on pages 36 and 37, which have been taken from Volume 16, Part 2, of the 1924 Transactions of The American Institute of Chemical Engineers.

But intelligent analyses of heat insulation problems require dependable basic data. First, the amount of loss from the bare hot surface must be known. Carey Bulletin 102A, Heat Losses from Bare Iron Surfaces, contains a digest of Heilman's* work on this subject, and Table No. 2, page 29, has been prepared from data in that bulletin for the benefit of those dealing with high temperatures. Then the suitability of materials must be considered even before an examination is made of the savings they may afford.

**1922 Transactions A. S. M. E.—p. 299.*

Limitation of Standard Types of Heat Insulation

Laminated Asbestos Felt or 85% Magnesia both provide entirely satisfactory insulation for pipes and surfaces up to a temperature of 500° F. At temperatures above 500° F. these high efficiency insulating materials must be protected from the destructive effects of high temperatures by other materials capable of withstanding such high temperatures.

Such protection is necessary because:

A. All Asbestos Papers or thin Asbestos Felts incorporate in their make-up a small percentage of organic binder. The binder, due to its organic nature, decomposes at higher temperatures. The burning out of the binder results in a weakening of the Asbestos Felt construction, as is shown graphically in Figure 1.

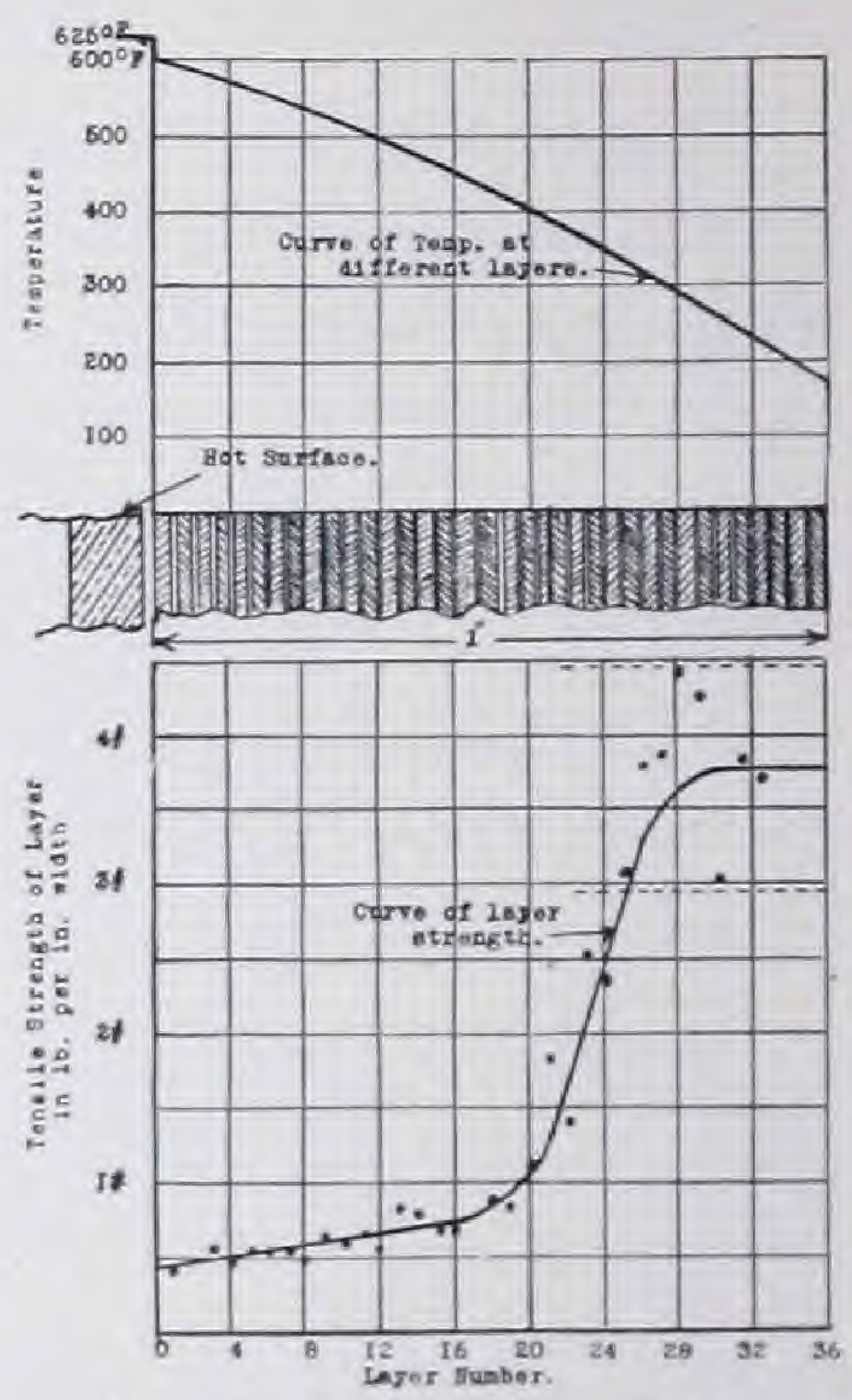


Figure 1 — *Effect of Heat on Laminated Asbestos Felt Covering

B. Carbonate of Magnesia ($4MgCO_3 \cdot Mg(OH)_2 \cdot 5H_2O$) begins to calcine at approximately 500° F. The water of combination and the carbon dioxide in the crystals are gradually driven off, and as the temperature increases, the calcination progresses, until, at a temperature of approximately 1000° F., complete calcination of the Carbonate of Magnesia has taken place. The Magnesia crystal has been transformed from the Carbonate to the Oxide. This transformation is accompanied by a loss of natural cohesion between crystals.

However, it has been demonstrated in actual service that partial decomposition both of Asbestos Felt and Magnesia crystals does not materially decrease the serviceability of coverings made of these structures. Asbestos Felt Insulations are used successfully up to a temperature of 500° F., and 85% Magnesia can be

*P. 543, July, 1920, Journal A. S. H. & V. E.

used with complete satisfaction up to a temperature of 550° F. These temperatures should probably be taken as the upper limits for sustained satisfactory service.

High Temperature Insulation

Materials which will withstand the deteriorating effects of high temperatures are plentiful, but those which will also give satisfactory heat-insulating characteristics are rare.

Molded Asbestos Insulation

Although some varieties of pure asbestos will withstand temperatures as high as 1200° F. without decomposition, asbestos, like any form of rock, transmits heat rapidly. Finely fiberized asbestos has fairly good insulating value, due to the entrapping of small "dead" air spaces; but in order to mold such asbestos into usable shapes, it is necessary to bond it with silicate of soda or other heat-resistant adhesive. The use of such bonding material considerably increases the rate of heat transmission, so that this type of insulation does not compare at all favorably with the better types of insulators such as 85% Magnesia, as is shown graphically in Figure 2.

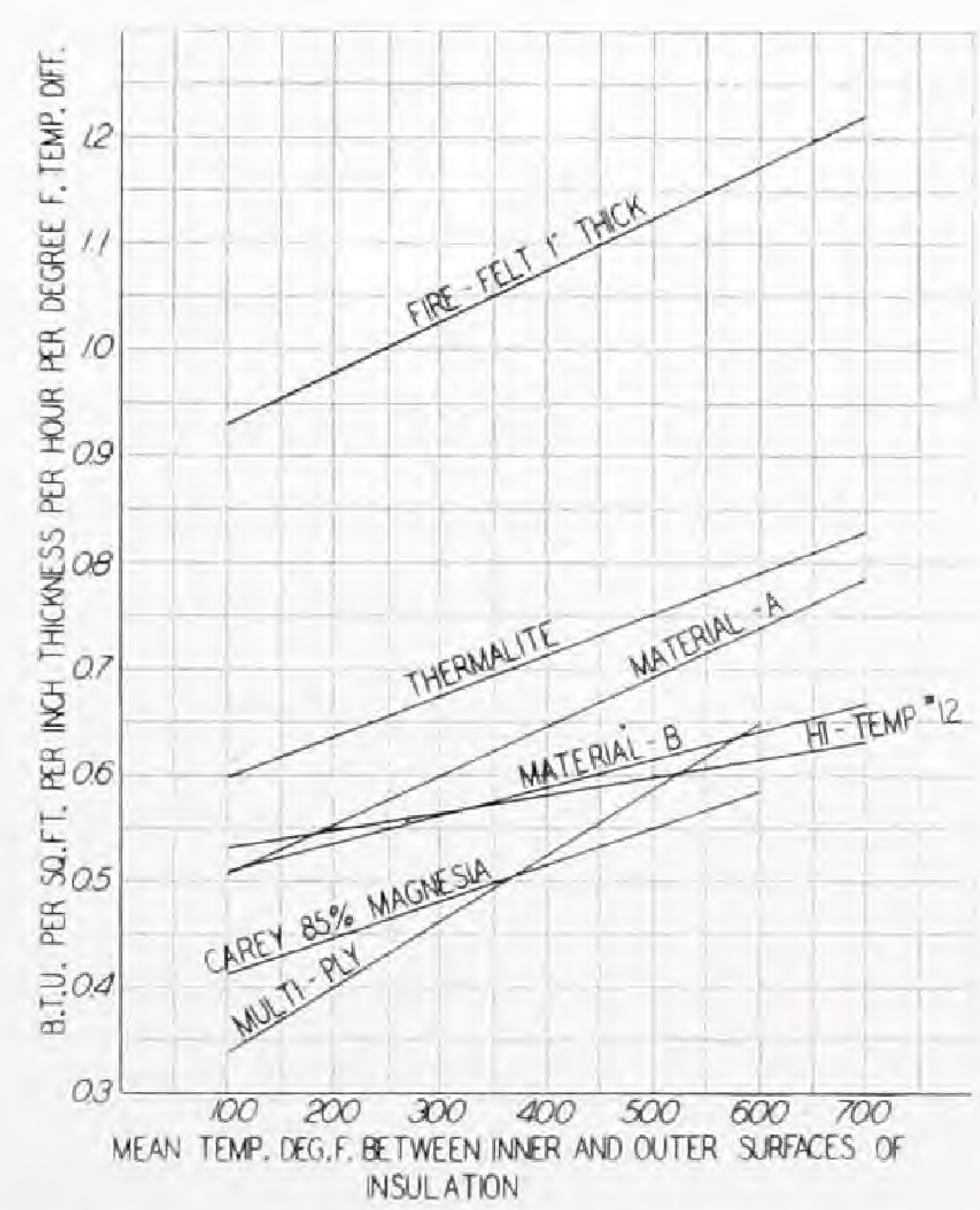


Figure 2 — *Conductivity Values of Various Commercial Heat Insulating Materials (1927 Trans. Nat. Dist. Heating Assn.).*

Molded Asbestos Fibre pipe coverings and blocks were extensively used for many years because this was the only type of high temperature insulation available.

Diatomaceous Earth Insulations

Diatomaceous or infusorial earth, a relatively pure porous form of silica, seems to possess the excellent combination of insulating value and high temperature resistance. For the past twenty-five or thirty years repeated efforts have been made to develop satisfactory commercial molded insulating materials from it.

The factor which renders this material impractical for heat insulation is its lack of cohesiveness. In order to mold it into suitable pipe covering forms having reasonable mechanical strength, it is necessary that the material be bonded by means of some additional agency. As in the case of molded asbestos insulation, the bonding material increases the rate of heat transmission and largely nullifies the natural value of the fine, porous earth.

The conductivity of one specimen made of Diatomaceous Earth (Material A), having reasonable strength, but lacking in insulating value, is shown in Figure 2, page 5. Another such product (Material B), also shown in Figure 2, has good insulating value, but lacks strength.

A decided brittleness, or easy breakage under jars and blows, is a very noticeable characteristic. Figure 3, page 7, shows three sections of pipe insulation all subjected to identically the same amount of "tumbling" in a rotary tester. The brittleness of "Material A" in comparison with 85% Magnesia is quite evident.

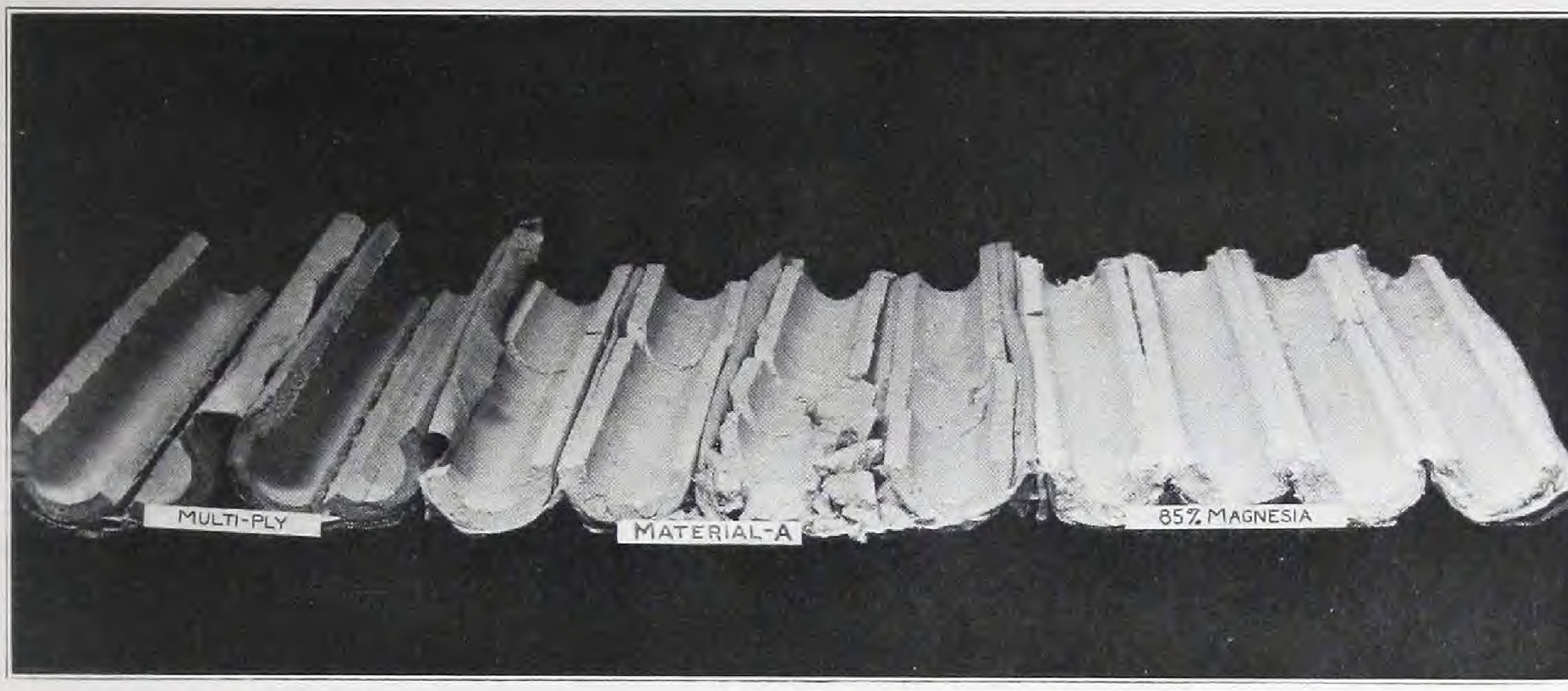


Figure 3—*Sections of various kinds of pipe coverings subjected to the tumbler test and showing relative brittleness.*

Fiberized Rock

Mineral or Rock Wool (stone or slag fluxed and blown) seems to offer possibilities because of resistance to high temperatures and good insulating properties, particularly in the lower temperature range. The individual fibres, however, are brittle. Some mechanical means must be employed either to bond or support this fibrous structure. This again means either sacrifice of insulating value or sacrifice of strength and durability.

Carey Hi-Temp No. 12

The Carey Research Laboratories gave careful consideration to the materials mentioned in the preceding paragraphs and to many other materials in their effort to develop a suitable heat insulation that would satisfactorily meet the following requirements:

1. High insulating efficiency.
2. Ability to resist decomposing effects of continuous exposure to high temperature.
3. Ability to withstand packing, shipping and handling without excessive breakage.
4. Low heat shrinkage.
5. Satisfactory mechanical strength and toughness to withstand handling and reapplication after exposure to high temperatures.
6. Resistance to the effects of moisture.

No one basic material with the addition of a little binder could satisfy all these requirements. In the development of Carey Hi-Temp No. 12 it was found necessary to use scientifically determined proportions of six commercial materials, including asbestos and compounds of silica, magnesia, calcium and alumina. By means of this combination, a material was obtained that more nearly approaches the ideal combination of all the required properties of high temperature insulation than any product yet offered for this purpose.

Heat Insulating Value

The heat transmission characteristic of Hi-Temp No. 12, shown in Figure 2, page 5, is taken from a paper by R. H. Heilman, presented at the May,

1927, meeting of the National District Heating Association. It not only shows that Hi-Temp No. 12 has a lower rate of heat transmission than any other high temperature insulating material, but the slope of the curve is particularly noteworthy. It will be seen that, as temperatures increase, the rate of heat transmission through Hi-Temp No. 12 increases quite slowly, which is an extremely desirable quality in high temperature insulating materials.

Strength and Durability

No high temperature material approaching Hi-Temp No. 12 in insulating value can compare with it in strength, toughness, heat resistance and water resistance; and the value of strength cannot be too strongly emphasized. At high temperatures, cracked or broken insulation offers easy channels for the escape of heat. Insulating materials must withstand shipment, handling, stocking and application. Breakage of insulating materials is due not so much to the slow application of stresses as it is to sudden impacts in the form of knocks, jars, vibration, etc., that is, stresses quickly applied. For this reason, the usual transverse bending test does not give a true index of serviceability. Brittleness, or its opposite quality, toughness, can be measured only by impact that tests both tensile strength and shearing resistance. A machine, Figure 4,

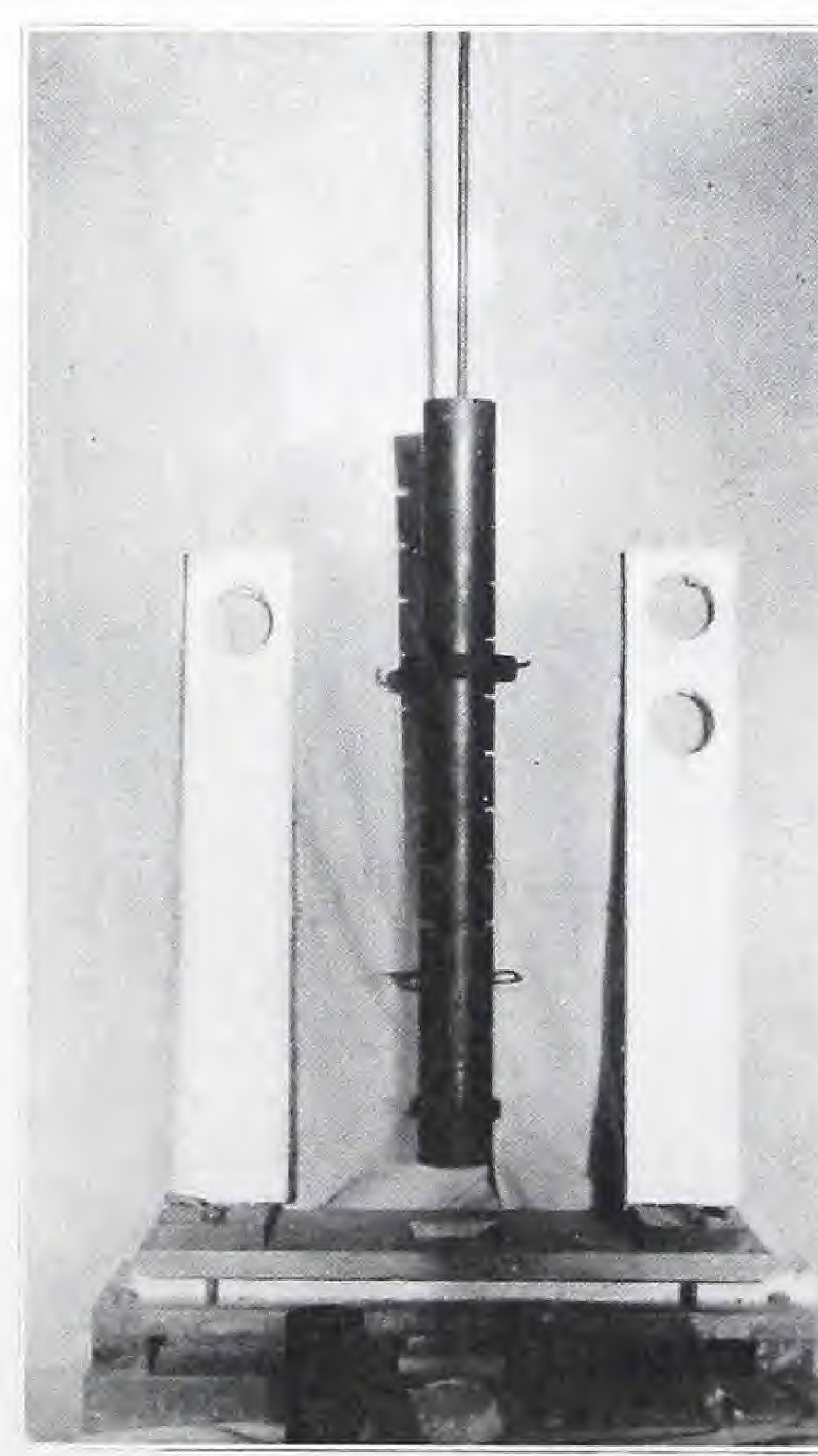


Figure 4—*Impact testing machine for determining toughness and resistance to breakage through sudden shock or impact*

was specially designed in the Carey laboratories for this kind of test. It gives values in terms of foot pounds necessary to cause failure of the test specimen. This is effected by dropping weights through measured distances. An interesting illustration of the relatively great strength of Hi-Temp No. 12 is given by the following comparison with a material which most nearly approaches it in insulating value:

Transverse Strength

Blocks 1½″ thick and 6″ wide supported on 10″ centers with load applied at center.

	As manufactured	After heating in electric oven for 24 hrs. at— 750° F.	1200° F.
Hi-Temp No. 12	80 lbs.	49 lbs.	22 lbs.
Material B	48 "	40 "	30 "
85% Magnesia	43 "		

Impact Resistance

FOOT POUNDS

	As manufactured	After heating in electric oven for 24 hrs. at— 750° F.	1200° F.
Hi-Temp No. 12	117	97	27
Material B	63	37	10
85% Magnesia	60		

From these figures it will be seen that even where the transverse test with slow application of load shows Hi-Temp No. 12 relatively weak at 1200° F., the impact test shows that it has practically three times greater resistance to impacts or sharp blows. This is the important quality which makes Hi-Temp No. 12 durable, and makes it possible to remove it and reapply it with a minimum of breakage and loss after it has been subjected to continuous high temperatures.

A visual demonstration of the reliability of this impact test as an index of brittleness, or its opposite quality, toughness, is obtained

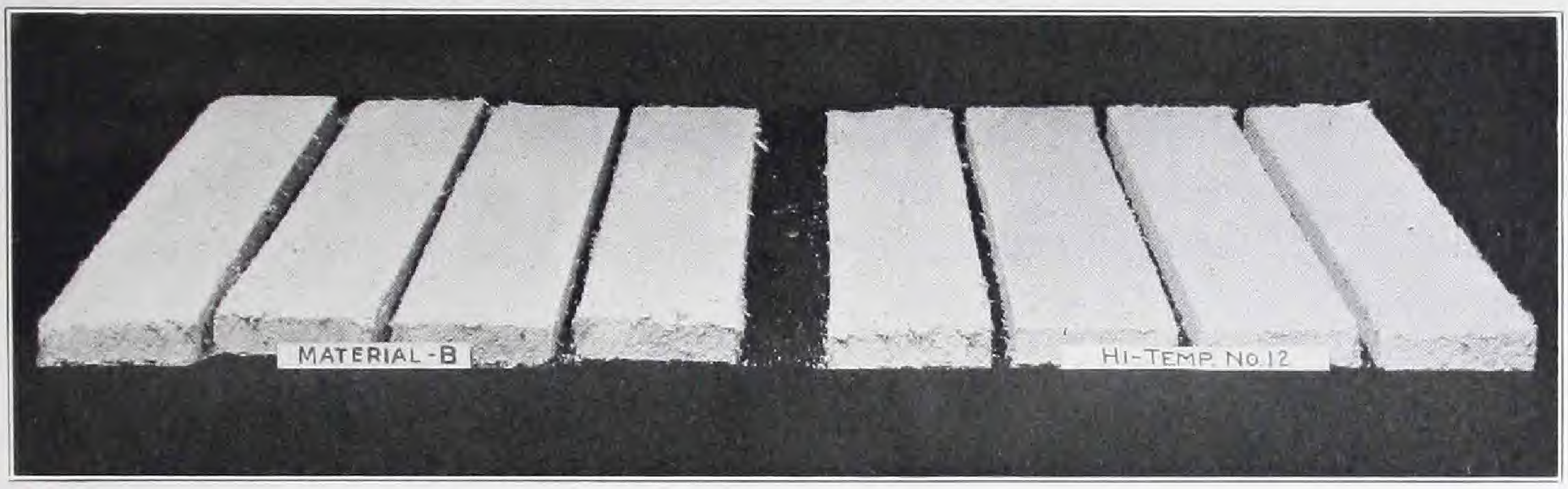


Figure 5—*New, unused blocks of Carey Hi-Temp No. 12 and a diatomaceous earth product (Material B).*

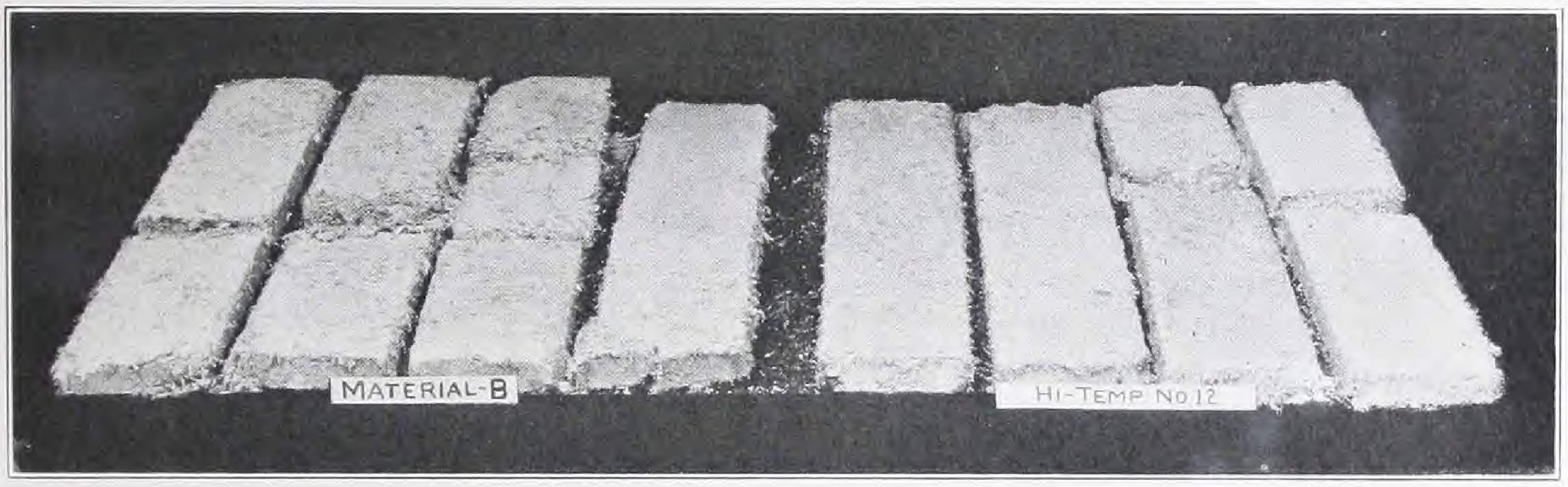


Figure 6—*Illustrating relative brittleness of Carey Hi-Temp No. 12 and a diatomaceous earth product (Material B).*

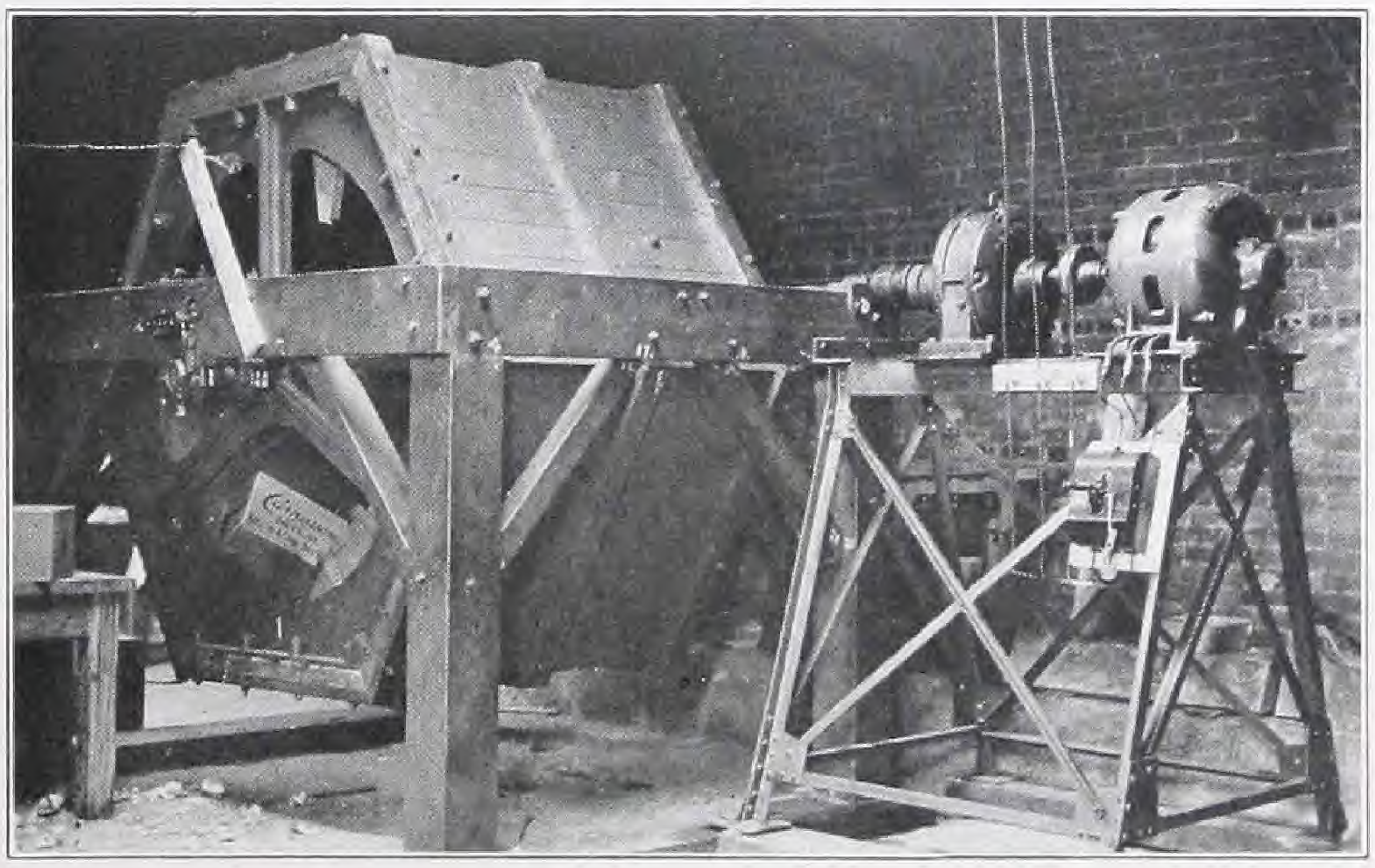


Figure 7—*Rotary Impact Tester for determining brittleness.*

from Figures 5 and 6, page 11. Figure 5 shows four blocks each of Hi-Temp No. 12 and Material B of the same general dimensions; these blocks were placed in the rotary impact tester, Figure 7, page 11, used for testing impact or shock resistance of shipping containers. It revolves at the rate of approximately one revolution per minute and contains six shelves or platforms so that one revolution gives six "drops." After one revolution the blocks had reached the condition shown in Figure 6. It will be seen that Material B shows four complete breaks and one partial break and most edges somewhat marred, while Hi-Temp No. 12 shows only two complete breaks and relatively clean-cut edges. The ratio of breakage is almost exactly the same as that indicated by the impact tester.

Permanent Lineal Heat Shrinkage

The following data are the result of the subjection of the insulation to the temperatures given, for 24 hours, in an electric furnace:

	750° F.	1200° F.
Hi-Temp No. 12	0.6%	0.95%
Material B	0.5%	1.0%

In the consideration of tests performed on samples subjected to soaking in an electric furnace where the entire block is subjected to the intense heat, it must be recognized that *the most severe conditions are being imposed on the material.* In practice, only one surface, the inner surface, of the block or section is subjected to the highest heat. The temperature decreases through the insulation, being considerably less at the outer surface of the block or section. Therefore, the average lineal shrink-

age will be less than that indicated as a result of electric furnace tests. This point should be borne in mind in considering all test data.

From a practical viewpoint, it is reasonable to consider the shrinkage of Hi-Temp No. 12 as negligible.

Resistance to Moisture

It is obvious that an insulation in order to be practical must have reasonable resistance to decomposition when subjected to moisture. Materials in transit, often by boat, and materials under poor storage conditions are quite

Figure 8

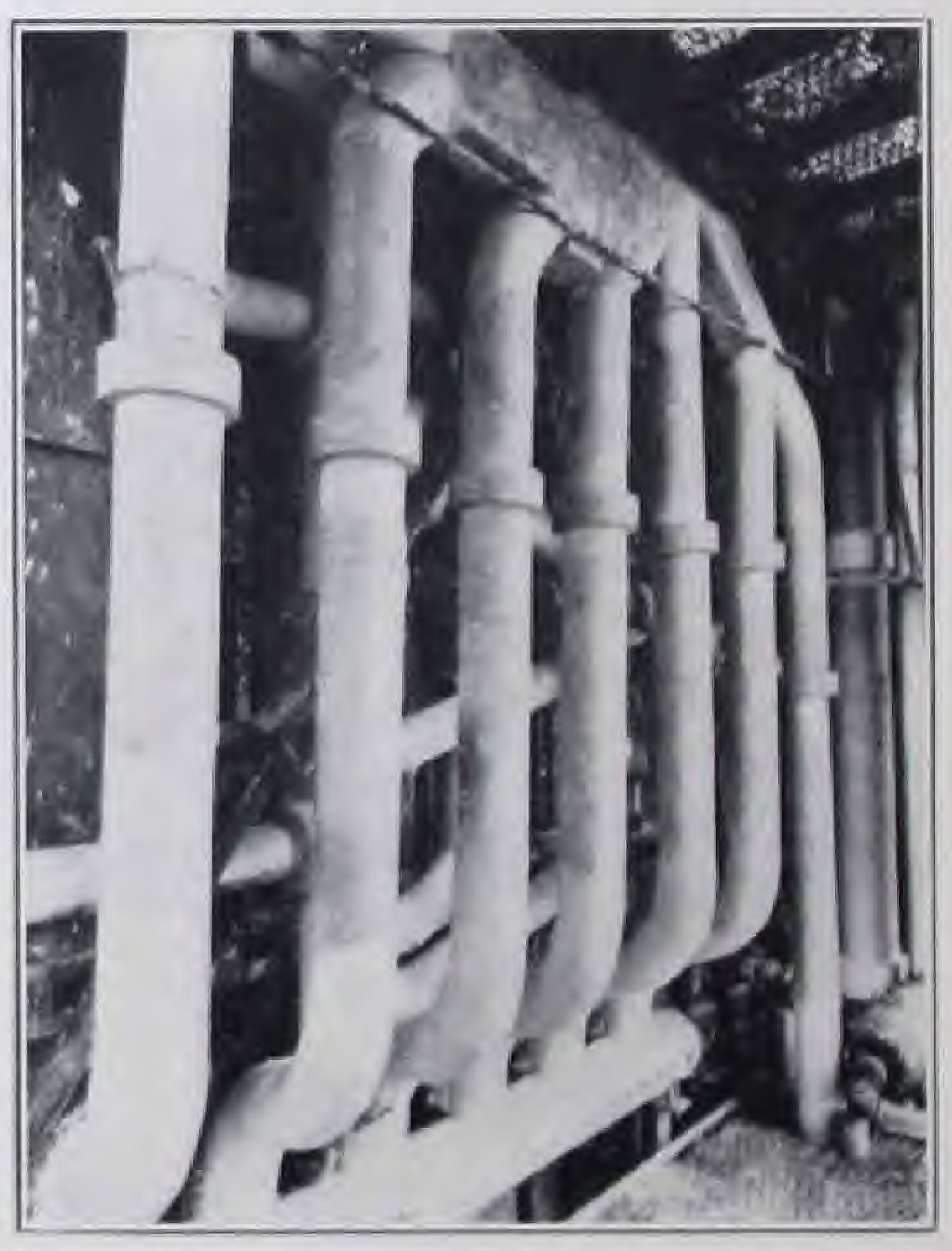
likely to be more or less subjected to moisture. The superior resistance of Hi-Temp No. 12 to the effects of moisture is one more strong feature in its favor. Figure 8 shows a small

sample of Hi-Temp No. 12 and a small sample of another commercial high temperature insulation after being soaked in water for twenty-four hours. It will be noted that, whereas the one material had swelled and separated and become practically useless, the Hi-Temp No. 12 had in no way changed its shape or consistency, and upon being dried out was as good as new.

Compound Heat Insulation

Since high temperature insulations cannot be made with as low conductivity as those used for lower temperatures, and are more costly, it is evident that only a sufficient thickness should be used as a first layer to reduce the temperature to within the safe limits at which 85% Magnesia or other insulating material can be used as an outer layer. In the case of the poorer high temperature insulators having relatively high rates of transmission compared with the outer layer, this thickness must be disproportionately large. In the case of Hi-Temp No. 12 with a heat transmission closely approaching that of 85% Magnesia, a minimum thickness is required. Tables Nos. 3 and 4, pages 30 and 31, give recommendations for the use of correct thicknesses of Hi-Temp No. 12 inner layers in combination with 85% Magnesia outer layers that will give exceptionally high insulating efficiency without subjecting the outer layer to a temperature beyond its safe limit. The tables give the intermediate temperatures between layers as well as the approximate outer canvas surface temperature, and the quantity of heat transmitted, so that a comparison of the saving with the first cost of the insulation can be quickly and easily made. Temperatures in pipes rarely exceed 800° F., and where heat insulation is required for such cases, full details should be submitted to our Engineering Department for recommendations.

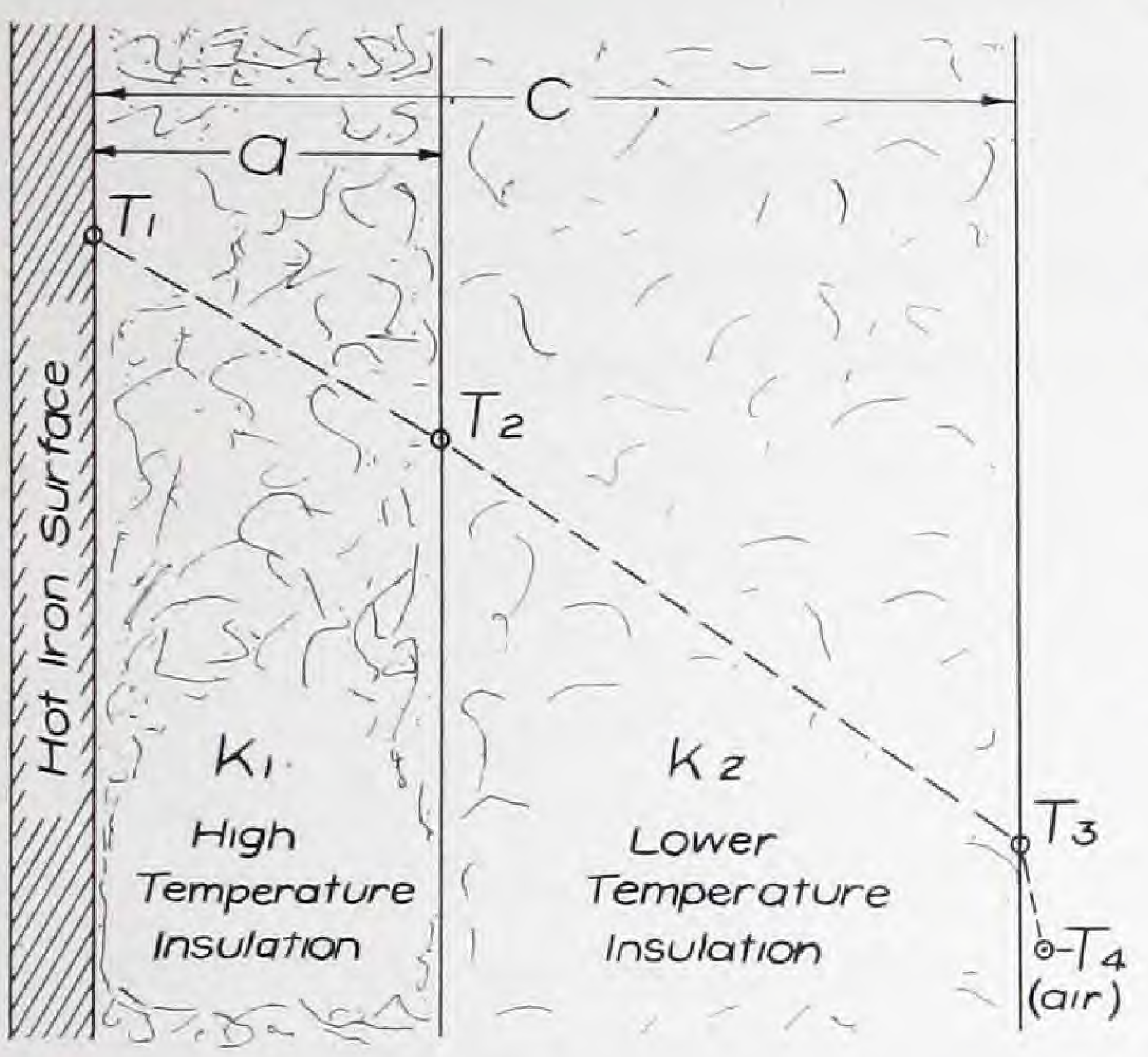
In the case of large surfaces requiring block or sheet construction, such as oil stills, ovens, etc., Tables Nos. 5, 6 and 7, pages 32, 33 and 34, give recommended combinations and thicknesses.



Florida Power & Light Company, Sanford, Fla. Designed by Electric Bond & Share Company of New York. Temperature 750° and 800°—insulated with Carey Hi-Temp No. 12 and Carey 85% Magnesia.

Calculation of Inner Layer Thickness

Where a compound insulation, other than those covered by the tables given in this bulletin, is to be used, the following simple formula can be employed to determine quickly and accurately the proper inner layer thickness *for flat or large curvature surfaces:*



$$a = \frac{C(T_1 - T_2)}{\frac{k_2}{k_1}(T_2 - T_3) + (T_1 - T_2)}$$

T_1—temperature of inner hot surface °F.

T_2—required maximum intermediate temperature at inner surface of outer layer insulation which is to be assumed at some value such as 500° F. or 550° F.

T_3—approximate temperature of outer surface of insulation which can be taken with sufficient accuracy from Table No. 1, depending upon temperature and total thickness of insulation involved.

k_1—conductivity of inner layer of insulation at its mean temperature between surfaces $\frac{(T_1 - T_2)}{2}$, which can be read from conductivity chart, Figure 2, page 5.

k_2—conductivity of outer layer of insulation at its mean temperature between surfaces $\frac{(T_2 - T_3)}{2}$, which can be read from conductivity chart, Figure 2, page 5.

a—thickness of inner layer of insulation in inches.

C—total thickness of both layers of insulation in inches.

Total Thickness of Insulation	Temperature Difference °F. Between Hot Surface (T_1) and Surrounding Air (T_4)						
	200	300	400	500	600	700	800
1 inch	115	134	154	174	199	211	231
1½ inch	102	119	136	151	169	187	205
2 inch	95	109	124	137	152	167	182
3 inch	88	99	109	120	131	142	154
4 inch	84	92	101	109	118	127	136

Table No. 1—Approximate Temperatures °F. of Outer Surfaces of Insulation (T_3), on Flat or Large Radius Surfaces, where High Efficiency Insulations are used, with Air Temperature at 70°F.

The solution of the problem merely requires an assumption of the total thickness (C) to be used; then all the other factors can be determined quickly and the equation solved for the inner layer thickness (a), which must be used with the total thickness (C) first assumed. In the event the type of construction used involves an inner layer of high temperature insulating material, a second layer of lower temperature insulating material, and a final finish coat of some type of asbestos cement, the problem still can be solved easily with sufficient accuracy for all engineering purposes by deducting three-fourths of the thickness of the outer cement layer from the total thickness (C) and then solve the equation as a two-layer combination, just as was done in the case first mentioned. For example: If 4½″ thickness of insulation is to be used, of which the third or outer layer is ½″ thickness of cement, then the total thickness (C) of the insulation is considered 4⅛″, and all other values are determined then as in the case of the two-layer construction.

It should clearly be understood that this method applies only to flat or nearly flat surface conditions, and that in the case of regular pipe sizes this method would give a greater thickness of the inner layer than is actually required. If it is desired to make accurate calculations of heat losses or temperature gradients, reference should be made to R. H. Heilman's paper, "Heat Losses Through Insulating Materials," in the October, 1924, issue of MECHANICAL ENGINEERING, or to a reprint of this paper, which will be supplied by us on request.

Large Sheet Insulation for High Temperatures

For insulating flat or large radius surfaces, it is often considered desirable to use insulation furnished in large sheets in order to reduce the number of joints and to make some reduction in the labor cost of application. This large sheet construction requires greater tensile strength than can be secured in Hi-Temp No. 12 or similar material. Such sheets must be almost entirely fibrous. The rate of heat transfer through such construction is somewhat higher than through Hi-Temp No. 12, but in the judgment of many engineers the mechanical advantages of the large sheet construction outweigh the lower efficiency.

Carey Thermalite is designed to meet the requirements of such large sheet insulation for temperatures from 600° F. to 1200° F. It has the molded fibrous construction which gives it the required strength, but is much lighter than any of the large blocks or sheets previously used, and is vastly superior in insulating value as can be seen by reference to the conductivity curves in Figure 2, page 5. Its strength is surprising, considering its lightness, and it can be shipped, handled and subjected to considerable abuse with a minimum of breakage. Shipments have been made from Cincinnati to Texas without the loss of a piece; and it has gone halfway around the world to far off Sumatra for use in the oil refineries located there, arriving in satisfactory condition.

If large sheet construction is desirable for the inner layer of high temperature insulating material, then it is equally desirable in the outer layer of lower temperature insulation.

Carey Multi-Ply is a laminated asbestos felt construction of very high efficiency, designed for this purpose. A combination inner layer of Thermalite and outer layer of Multi-Ply in proper proportions and thicknesses give the maximum insulating value that can be obtained from large sheet construction. Multi-Ply

sheets can also be used over Hi-Temp No. 12 blocks if desired. Tables Nos. 5, 6 and 7, on pages 32, 33 and 34, give various combinations of Hi-Temp No. 12 or Thermalite inner layers with 85% Magnesia or Multi-Ply outer layers.

CEMENT

High Temperature Insulating Cement

In the installation of blocks and sheets, particularly on irregular surfaces, care should be taken to fill all cracks and spaces with a suitable cement or plastic high temperature insulation having good insulating properties.

Asbestos cements are intended as a finishing coat for various types of insulation. They are not designed primarily from an insulating standpoint. Asbestos cements usually contain a substantial quantity of clay, in order to provide plasticity, sticking ability, and smooth finishing properties.

In the past, stress has been laid on long fibered asbestos cements, but from the discussion which has gone before, it may be obvious that long fibre does not necessarily result in insulating efficiency.

Figure 9 shows the wide variation in insulating value of asbestos cements, which, when compared with Figure 2, page 5, shows the relatively poor value of such materials from a heat-saving point of view.

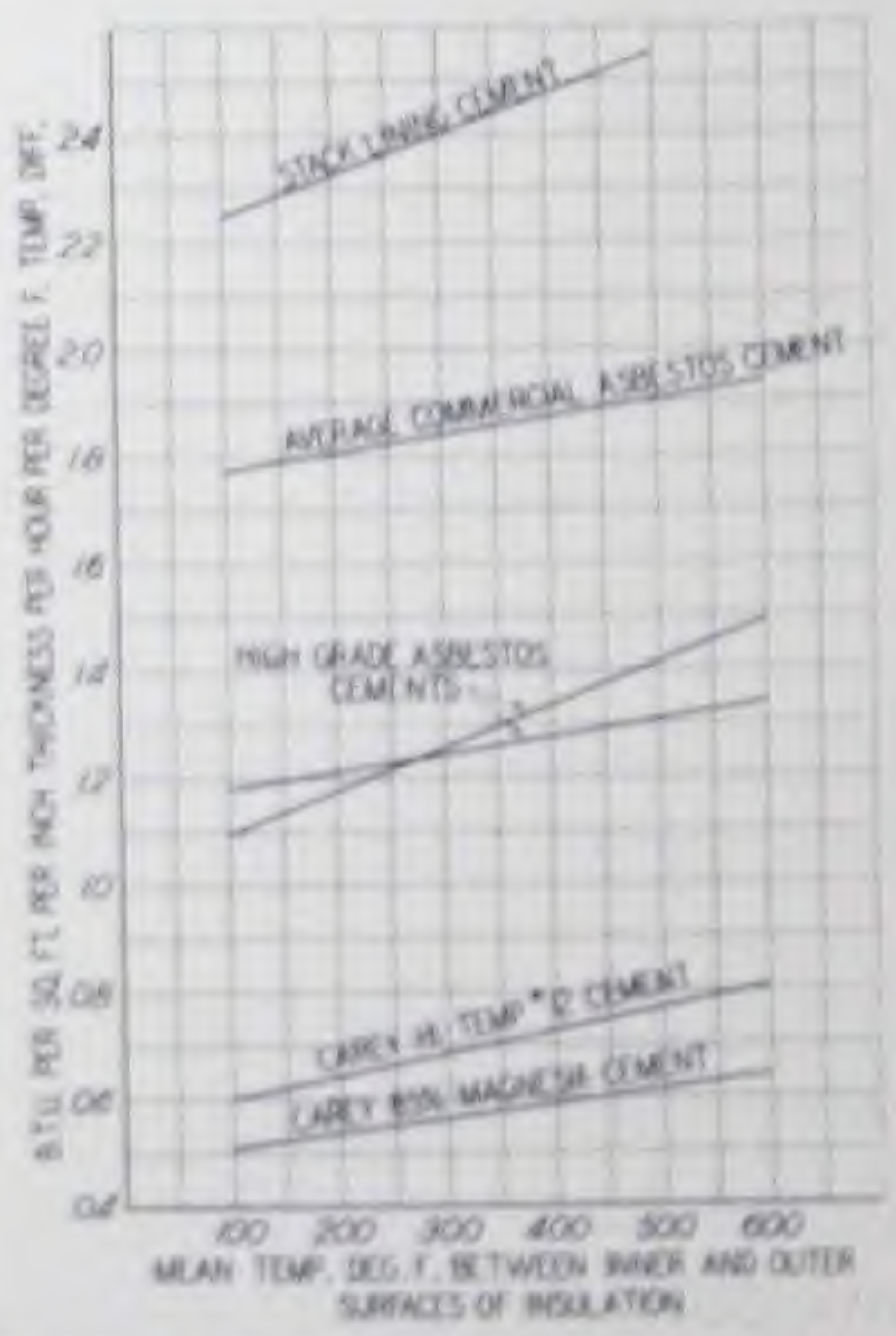


Figure 9—Conductivity value of insulating cement.

Hi-Temp No. 12 cement is primarily designed to give maximum heat-insulating value at high temperatures. It is merely a powdered form of Hi-Temp No. 12 molded insulation, and therefore gives the same insulating value. It should be used exclusively in setting up the first layer of high temperature block or sheet insulating material.

It seems to be a characteristic of high grade insulating cements such as 85% Magnesia and Hi-Temp No. 12 to shrink upon drying. This means that if Hi-Temp No. 12 cement only is used for insulating purposes on large surfaces, such shrinkage cracks must be pointed up before successive layers of cement are applied.

Although Hi-Temp No. 12 cement trowels hard and smooth, it should not be used alone as a finish coat. The final coat of cement, usually from 1/4" to 1/2" thick, should be composed either of a mixture of 3 parts of Hi-Temp No. 12 cement with one part of Portland cement by weight or a standard hard finish cement such as Carey No. 100.

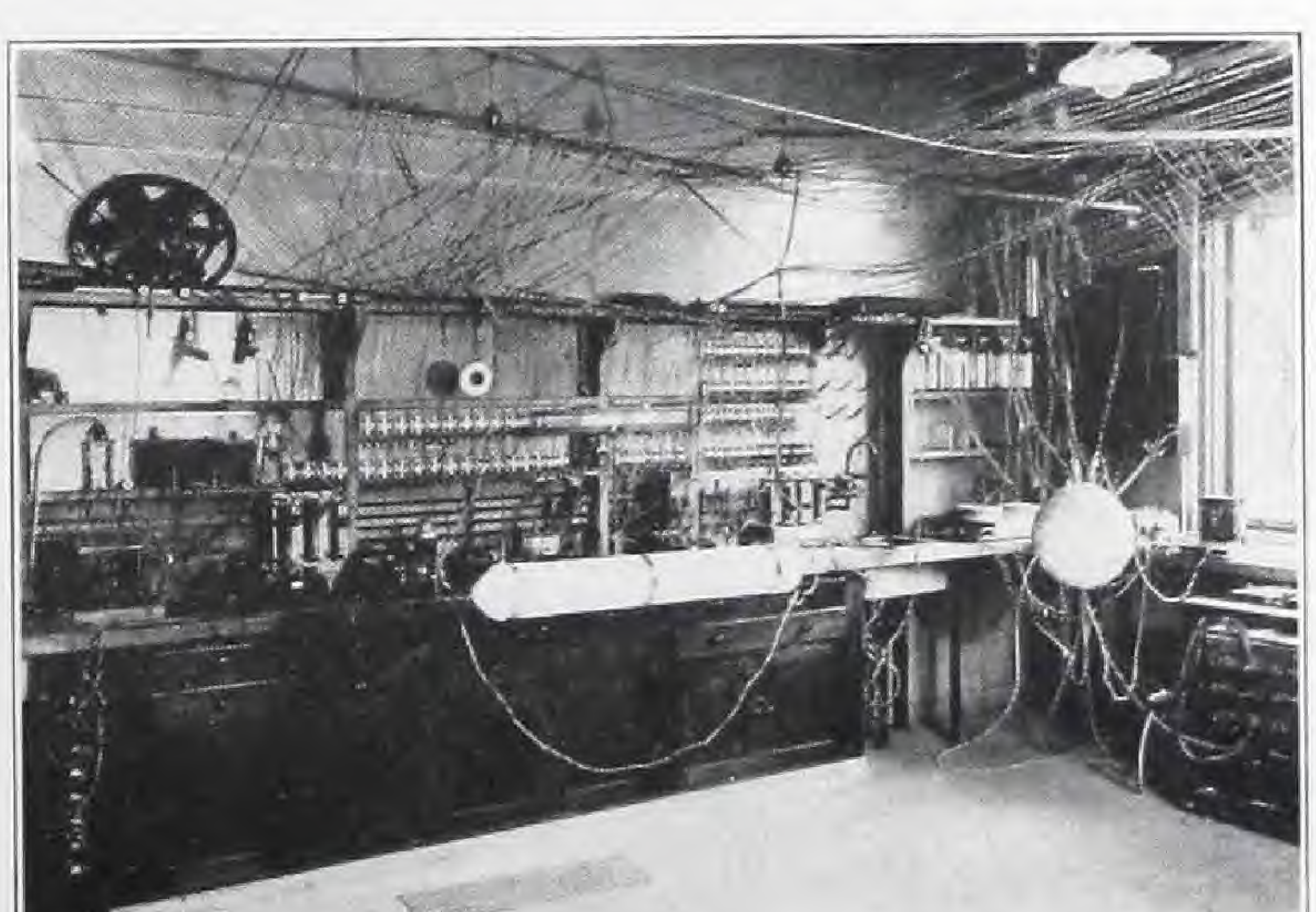
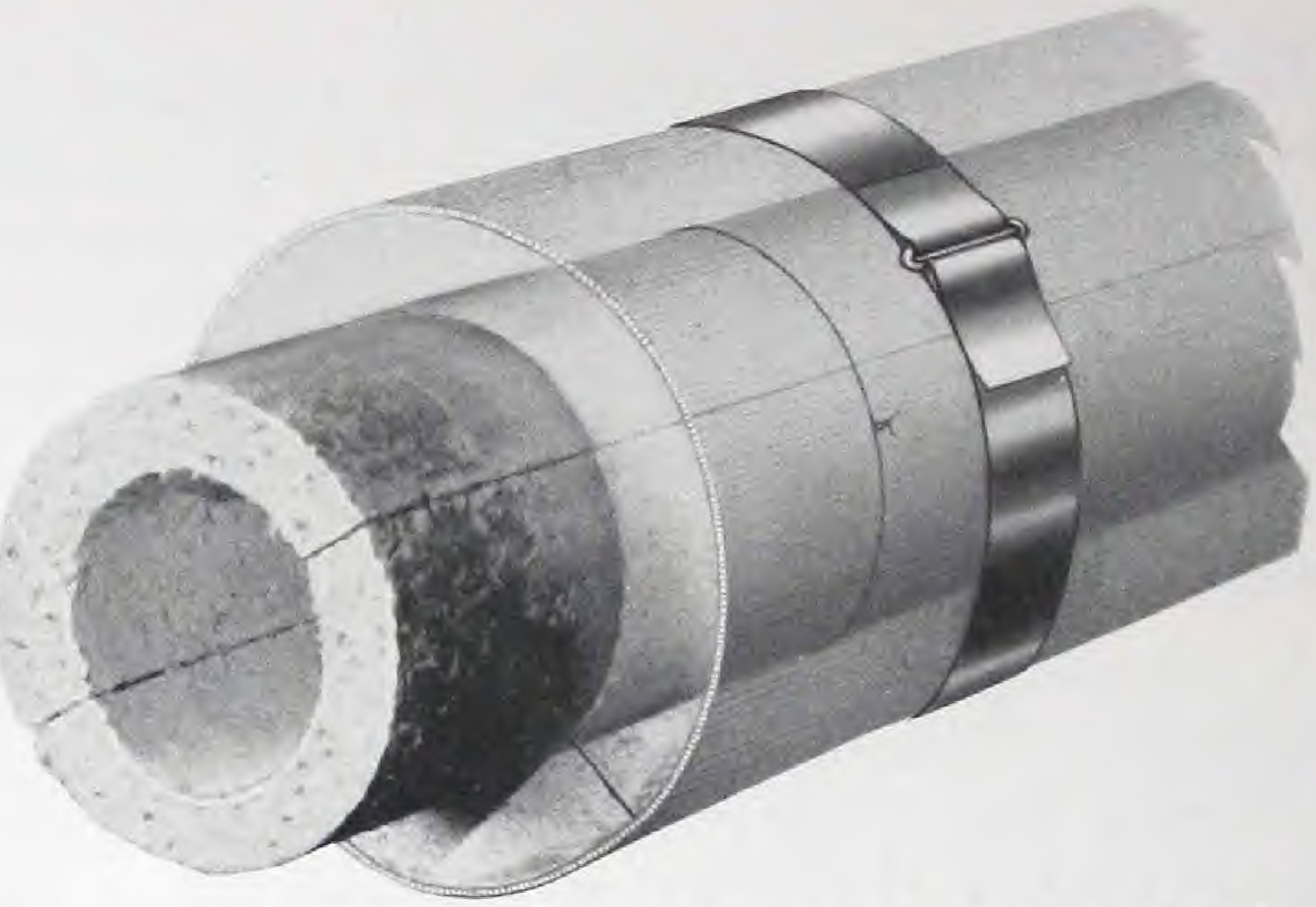


Figure 10—*Shows the specially designed spherical cement tester used in the Carey Research Laboratories for accurately determining insulating value, sticking and shrinking qualities of cements.*



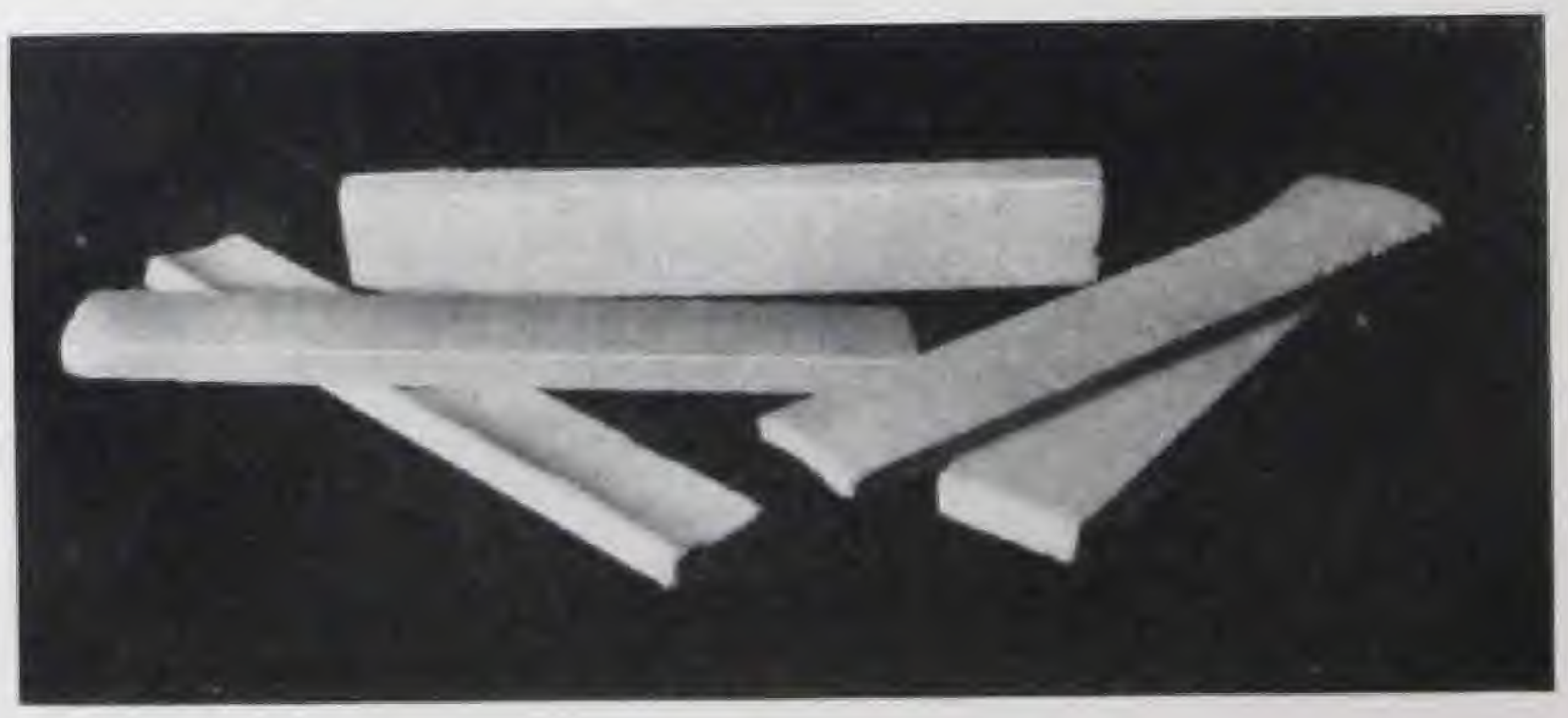
CAREY HI-TEMP No. 12 heat insulation consists of selected insulating and bonding materials scientifically compounded, and is designed for use at temperatures up to 1200° F. In permanent installations under conditions where it will not be subjected to abuse or mechanical strain such as in lining boiler casings, it can be used satisfactorily up to 1600° F.

The insulating value and mechanical strength of Hi-Temp No. 12 at any temperature within its useful range has proved superior in every test to any other commercial heat insulation suitable for high temperatures. See pages 5, 10 and 11 for test data. It is a product of carefully conducted scientific laboratory research work over a period of years.

Carey Hi-Temp No. 12 is designed for use as a first layer in combination with other heat-insulating materials for pipes or other surfaces operating at temperatures of 550° F. or higher. Its purpose is to reduce the initial high temperature to within the safe limits of the outer layer insulating materials. For proper combinations to use, see pages 30, 31, 32, 33 and 34.

Sectional and segmental (curved blocks) pipe coverings, also flat and curved blocks for large radius surfaces, are supplied in the thicknesses and sizes listed on the opposite page.

Hi-Temp No. 12 insulating cement is a powdered form of the molded insulation, and has the same heat-resisting and high insulating properties. It should be used exclusively in setting up Hi-Temp No. 12 blocks or pipe coverings. To apply, simply mix it with water to the consistency of mortar. It is furnished in 60-pound bags and has a covering capacity of approximately 32 to 35 square feet 1-inch thick per 100 pounds.



CAREY HI-TEMP No. 12 HEAT INSULATION

Sizes, Thicknesses, List Prices and Combinations

	Approx. Wt. Per Lin. Ft.	List Price
For ½" pipe — 1½" thick	1.80 lbs.	per ft. $0.46
For ½" pipe — 2" thick	3.30 lbs.	per ft. 0.75
For ¾" pipe — 1½" thick	1.72 lbs.	per ft. 0.49
For ¾" pipe — 2" thick	3.37 lbs.	per ft. 0.80
For 1" pipe — 1½" thick	2.50 lbs.	per ft. 0.52
For 1" pipe — 2" thick	3.70 lbs.	per ft. 0.85
For 1¼" pipe — 1½" thick	2.55 lbs.	per ft. 0.56
For 1¼" pipe — 2" thick	3.90 lbs.	per ft. 0.90
For 1½" pipe — 1½" thick	2.85 lbs.	per ft. 0.60
For 1½" pipe — 2" thick	4.23 lbs.	per ft. 0.95

For pipe sizes ½" to 1½" inclusive, Hi-Temp No. 12 is furnished with canvas jacket and metal bands. No outer layer pipe covering is required.

For pipe sizes 2" and larger Hi-Temp No. 12 is intended for use as the inner layer in double layer construction, and no canvas or metal bands are furnished.

	Approx. Wt. Per Lin. Ft.	List Price	Outer Layer Pipe Sizes	Outer Layer List Prices Standard	1½" th'k	2" th'k	2½" th'k
For 2" pipe — 1 1/32" thick	1.93 lbs.	per ft. $0.36	4"	$0.60	$0.88	$1.35	.....
For 2½" pipe — 1 1/32" thick	2.20 lbs.	per ft. 0.40	4½"	.65	.94	1.45	.....
For 3" pipe — 1 1/32" thick	2.57 lbs.	per ft. 0.45	5"	.70	1.00	1.55	.....
For 3½" pipe — 1 9/32" thick	3.58 lbs.	per ft. 0.82	6"	.80	1.10	1.70	.....
For 4" pipe — 1½" thick	4.87 lbs.	per ft. 0.88	7"	1.00	1.20	1.85	.....
For 4½" pipe — 1 9/32" thick	4.23 lbs.	per ft. 0.94	7"	1.00	1.20	1.85	.....
For 5" pipe — 1½" thick	5.82 lbs.	per ft. 1.00	8"	1.10	1.35	2.00	.....
For 6" pipe — 1½" thick	6.83 lbs.	per ft. 1.10	9"	1.20	1.50	2.20	.....
For 7" pipe — 1½" thick	7.47 lbs.	per ft. 1.20	10"	1.30	1.65	2.40	.....
For 8" pipe — 1½" thick	7.87 lbs.	per ft. 1.35	*Spec.	1.60	1.75	2.55	$3.20
For 9" pipe — 1½" thick	9.20 lbs.	per ft. 1.50	**12"	1.85	1.85	2.70	3.40
For 10" pipe — 1½" thick	10.17 lbs.	per ft. 1.65	**14"	2.10	2.10	3.00	3.80
For 12" pipe — 1½" thick	12.23 lbs.	per ft. 1.85	**15"	2.22	2.22	3.15	4.00
For 14" pipe — 1½" thick	13.33 lbs.	per ft. 2.10	**17"	2.47	2.47	3.45	4.40
For 16" pipe — 1½" thick	14.90 lbs.	per ft. 2.35	**19"	2.72	2.72	3.80	4.80
For 18" pipe — 1½" thick	16.66 lbs.	per ft. 2.60	**21"	2.96	2.96	4.13	5.20
For 20" pipe — 1½" thick	18.00 lbs.	per ft. 2.85	**23"	3.19	3.19	4.37	5.60
For 24" pipe — 1½" thick	21.33 lbs.	per ft. 3.30	**27"	3.65	3.65	5.00	6.40
For 30" pipe — 1½" thick	26.67 lbs.	per ft. 4.00	**33"	4.35	4.35	6.00	7.60

Hi-Temp No. 12 pipe covering is furnished in 3-foot long, semi-cylindrical sections for standard wrought iron pipe sizes up to and including 10 inches. Segments (curved blocks) 3 feet long and approximately 6 inches wide are furnished for larger pipe sizes.

Crated or shipping weights of Hi-Temp No. 12 sectional *pipe coverings* run from 20% to 35% greater than bulk weights, depending upon sizes, nesting, combinations, etc. 7½% of list price is approximately equal to freight cost for a $1.00 per cwt. freight rate.

Standard thickness 85% Magnesia (see page 25) and all other 1-inch thick pipe coverings are priced on the "Standard" list.

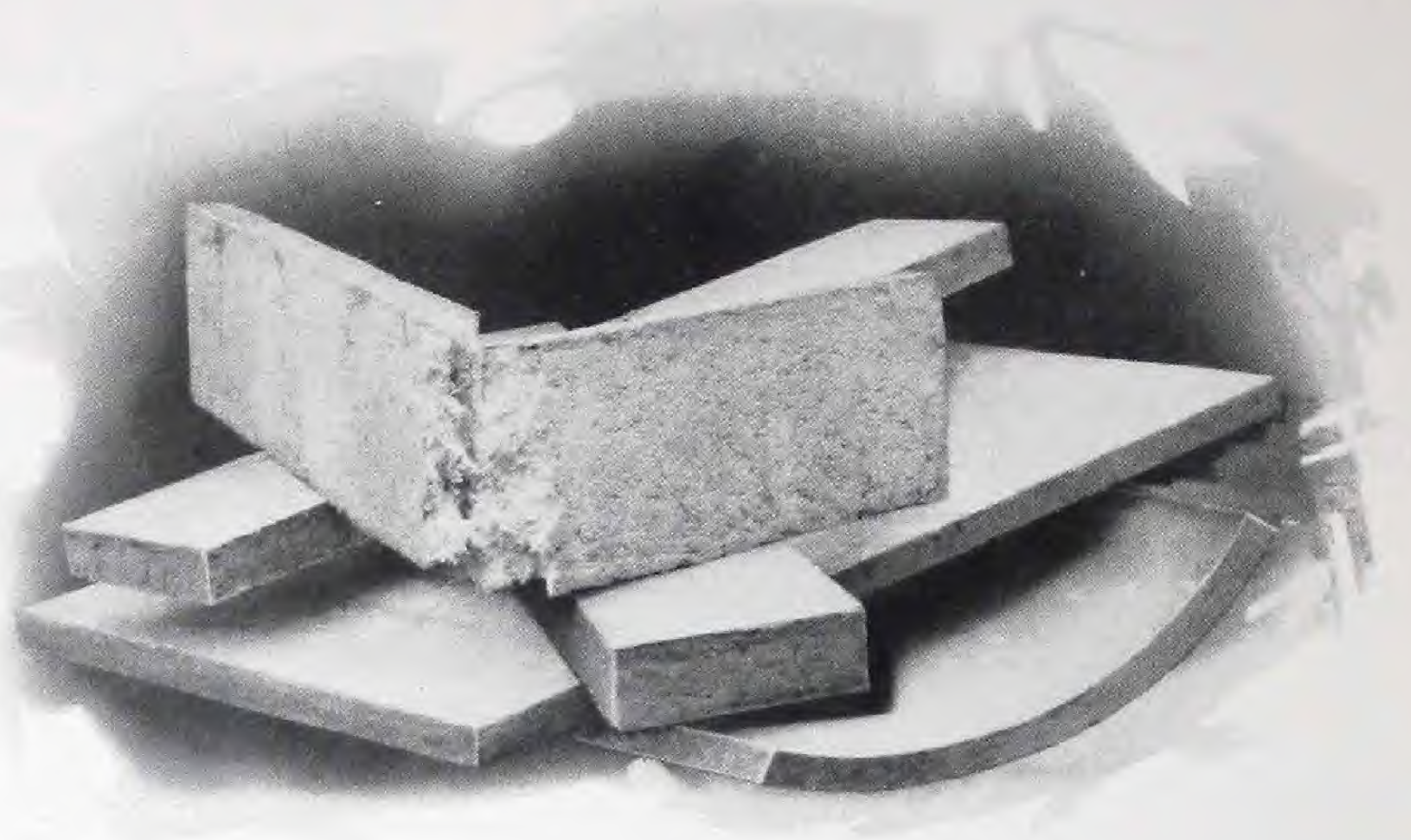
	Approx. Wt. Per Sq. Ft.	List Price
HI-TEMP No. 12 BLOCKS, flat, 6" wide, 36" long, 1" thick	2.25 lbs	per sq. ft. $0.30
No. 12 BLOCKS, flat, 6" wide, 36" long, 1¼" thick	2.80 lbs	per sq. ft. 0.38
No. 12 BLOCKS, flat, 6" wide, 36" long, 1½" thick	3.40 lbs	per sq. ft. 0.45
No. 12 BLOCKS, flat, 6" wide, 36" long, 1¾" thick	4.00 lbs	per sq. ft. 0.53
No. 12 BLOCKS, flat, 6" wide, 36" long, 2" thick	4.50 lbs	per sq. ft. 0.60
No. 12 BLOCKS, flat, 6" wide, 36" long, 2½" thick	5.60 lbs	per sq. ft. 0.75
No. 12 BLOCKS, flat, 6" wide, 36" long, 3" thick	6.70 lbs	per sq. ft. 0.90

Curved Hi-Temp blocks approximately 6 inches wide and 36 inches long can be furnished for diameters from 30 inches to 90 inches. These curved blocks are priced on their outside area taken from the standard lagging table.

Shipping weights of Hi-Temp No. 12 *blocks* are approximately 15% greater than bulk weights. 9% of list price is approximately equal to freight cost for a $1.00 per cwt. freight rate.

*Special sectional outer layer furnished in 85% Magnesia in Standard, 1½" and 2" thickness; 2½" thickness furnished in curved blocks.

**Outer layer of 85% Magnesia furnished in curved blocks; all *smaller pipe size* outer layers furnished in 3 ft. long semi-cylindrical sections. Outer layer coverings made of laminated asbestos felts furnished in 3 ft. long cylindrical sections for all pipe sizes.



CAREY Thermalite asbestos sheets and blocks consist mainly of carefully prepared, long, brown Amosite asbestos molded to desired size and shape and bonded with heat-resisting materials. Amosite asbestos has a peculiar springy quality lacking in the Canadian product, which makes it possible to mold a relatively light block having a very high insulating value in comparison with molded Canadian asbestos blocks.

Thermalite is designed for use at temperatures up to 1200° F. either by itself or as a first layer in combination with other heat-insulating materials. It is a very satisfactory material for lining breechings, for lining gas heated equipment, for use as a first layer on high temperature oil stills or other high temperature equipment. See Table No. 7, page 34, for specifications.

While the insulating value of Thermalite is slightly less than that of Hi-Temp No. 12, see Figure 2, page 5, it has the advantage of large sheet construction as against small block construction, and in many cases this is a sufficiently desirable feature to call for its use.

It is furnished in standard sheets 24″x36″, either flat or curved to radius, or in standard flat blocks 6″ wide by 36″ long, and in thicknesses from 1″ to 4″ inclusive. It weighs approximately two pounds per square foot 1″ thick, and other thicknesses weigh in proportion. The shipping weight is approximately 20% greater.

SPECIFICATIONS

For Insulating High Temperature Pipes, Fittings, etc., With Hi-Temp No. 12 and 85% Magnesia or Multi-Ply

THICKNESS

For Temperatures 650° F. to 800° F.

(For complete details of thicknesses, heat losses, temperatures, etc., see page 31.)

Pipe sizes ½″ to 1½″ inclusive:

Apply 2″ thick Hi-Temp No. 12 only in single layer.

Pipe sizes 2″ to 4½″ inclusive:

Apply a first layer of Hi-Temp No. 12 not less than 1″ thick and a second layer of 85% Magnesia or Multi-Ply not less than 2″ thick.

Pipe sizes 5″ to 8″ inclusive:

Apply a first layer of Hi-Temp No. 12 not less than 1½″ thick and a second layer of 85% Magnesia or Multi-Ply 2″ thick.

Pipe sizes 9″ and larger:

Apply a first layer of Hi-Temp No. 12 not less than 1½″ thick and a second layer of 85% Magnesia or Multi-Ply 2½″ thick.

For Temperatures 550° F. to 650° F.

(For complete details of thicknesses, heat losses, temperatures, etc., see page 30.)

Pipe sizes ½″ to 1½″ inclusive:

Apply 1½″ thick Hi-Temp No. 12 only in single layer.

Pipe sizes 2" to 4½" inclusive:

Apply a first layer of Hi-Temp No. 12 not less than 1" thick and a second layer of 85% Magnesia or Multi-Ply not less than 1½" thick.

Pipe sizes 5" to 8" inclusive:

Apply a first layer of Hi-Temp No. 12 not less than 1½" thick and a second layer of 85% Magnesia or Multi-Ply 1½" thick.

Pipe sizes 9" and larger:

Apply a first layer of Hi-Temp No. 12 not less than 1½" thick and a second layer of 85% Magnesia or Multi-Ply 2" thick.

For Temperatures Below 550° F.

85% Magnesia or Carey Multi-Ply laminated asbestos felt coverings only should be used for these temperatures. Hi-Temp No. 12 is not required. The following table gives the economic thicknesses for various temperature ranges:

	Pipe Sizes ½" to 3½"	Pipe Sizes 4" to 10"	Pipe Sizes 12" and larger
450° F. to 550° F.		Double	Double
Carey 85% Magnesia	2"	St'd Th'k	St'd Th'k
Carey Multi-Ply	2"	2½"	3"
350° F. to 450° F.		Double	Double
Carey 85% Magnesia	1½"	St'd Th'k	St'd Th'k
Carey Multi-Ply	1½"	2"	2½"
250° F. to 350° F.			
Carey 85% Magnesia	St'd Th'k	1½"	2"
Carey Multi-Ply	1"	1½"	2"

150° F. to 250° F.			
Carey 85% Magnesia	St'd Th'k	St'd Th'k	1½"
Carey Multi-Ply	1"	1"	1½"

All Multi-Ply coverings 2" or greater in thickness should be of double layer construction; less thicknesses of single layer construction. "Double Standard" thickness 85% Magnesia coverings should be of double layer construction; all other thicknesses of single layer construction.

Standard and Double Standard Thickness 85% Magnesia

Pipe Sizes:	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	6"	7"	8"	9"	10"	12" and larger
Standard Thickness:	⅞"	⅞"	⅞"	⅞"	⅞"	1 1/32"	1 1/32"	1 1/32"	1 1/32"	1⅛"	1⅛"	1⅛"	1⅛"	1¼"	1¼"	1¼"	1¼"	1½"
Double Standard Thickness:	1 29/32"	1 29/32"	1 29/32"	1 29/32"	1 29/32"	2 5/32"	2 5/32"	2 5/32"	2 5/32"	2¼"	2¼"	2⅜"	2⅜"	2½"	2½"	2½"	2½"	3"

The terms "Standard" thickness and "Double Standard" thickness apply only to 85% Magnesia pipe coverings. All other coverings are furnished in uniform thickness, such as 1", 1½", 2", etc., for all pipe sizes.

PIPING

APPLY single thickness pipe coverings with tight seams and joints. Fill all open cracks, depressions or voids with insulating cement. Use Hi-Temp No. 12 Cement with Hi-Temp No. 12 Covering and 85% Magnesia Cement with 85% Magnesia or Multi-Ply Covering. Paste down smoothly all laps of the 4 oz. canvas jacket, with which the covering is finished. Apply black japanned metal bands on 18″ centers.

Apply all double layer coverings by the staggered or broken joint method. Securely wire the first layer of covering with No. 18 Annealed Wire, using at least three loops for each three-foot long section. Fill all cracks or voids with insulating cement. Use Hi-Temp No. 12 Cement with Hi-Temp No. 12 Covering and 85% Magnesia Cement with 85% Magnesia or Multi-Ply. No canvas jacket is required on the first layer. Apply the second layer of 85% Magnesia or Multi-Ply Covering so that no seams or joints coincide with the first layer. Fill in cracks or voids with 85% Magnesia Cement. Wire the second layer securely in place with No. 18 Annealed Iron Wire, using not less than three loops for each three-foot long section. Apply a layer of 16-pound asbestos paper, and finish with either a 4 oz. or 6 oz. canvas jacket smoothly pasted on, or an 8 oz. canvas jacket sewed in place with not less than three stitches to the inch. The use of black japanned metal bands is optional, but they are not necessary. At flanges either bevel the pipe covering or provide narrow rings of insulation which can be quickly removed to permit easy removal of bolts.

FITTINGS

Cover all pipe fittings at 550° F. and higher, including the bodies of flanged fittings, with a first layer of Hi-Temp No. 12 Blocks and Hi-Temp No. 12 Cement, or all Hi-Temp No. 12 Cement, and a second layer of 85% Magnesia Blocks and Cement, or all 85% Mag-

nesia Cement in the same proportions and to the same total thickness as the insulating covering on the adjacent pipes. Cover all fittings at lower than 550° F. with 85% Magnesia Blocks and Cement or all 85% Magnesia Cement to the same thickness as the insulating covering on the adjacent pipes. Trowel the outer surface smooth, and finish with canvas jacket, to match the sectional covering, smoothly pasted on.

FLANGES

Cover all flanges at 550° F. and higher, including flanges on fittings, with an inner layer of Hi-Temp No. 12 and an outer layer of 85% Magnesia, each layer to be of the same thickness as the corresponding insulating covering on the adjacent piping except that the maximum total thickness of the flange covering required is 3″, consisting of an inner layer of 1½″ thick Hi-Temp No. 12 and an outer layer of 85% Magnesia and Asbestos Cement. Cover all flanges at lower than 550° F. with 85% Magnesia or Multi-Ply to the same thickness as the insulating covering on the adjacent pipes. Make flanges in the form of sleeves of sufficient length to lap the adjacent ends of pipe covering at least 2″, and reenforce with wire mesh or sheet metal, so that sleeves may be removed and reapplied. Fill any space where the sleeve overlaps the adjacent pipe covering with insulating cement. Trowel all exposed surfaces of flange sleeve to a smooth finish, and securely paste on a canvas jacket of the same weight as used on adjacent covering.

EXPOSED PIPES

On all pipes exposed to the weather or moisture, omit the canvas jacket, and in its place use asbestos roofing jackets having a weight of approximately 55 pounds per square. Lap these jackets at least 2″ at butt joints and 3″ at lateral joints, sticking such laps down with Lap Cement. Hold jackets in place with No. 16 Copper Wire loops on 4″ centers.

BREECHING

Insulate the smoke breeching connecting the boilers to the stack with 2″ thick Hi-Temp No. 12 Blocks applied over V-rib air space netting, or by other suitable means, to provide an air space of not less than 1″. (The air space may be secured by means of ¼″ diameter iron rods spaced on 6″ centers and running through the supporting angles of the breeching, or by spot welding 4″ square No. 12 gauge wire netting to expansion ribs or supporting angles.) Finish with Asbestos Cement not less than ½″ thick, in which is embedded a reenforcement of 1″ iron wire mesh. Apply the cement in two coats, the last coat being troweled to a smooth, hard finish.

HOT AIR DUCTS

For Hot Air Ducts carrying temperatures of 400° F. to 500° F., insulate with 2″ thick 85% Magnesia blocks. For temperatures below 400° F., insulate with 1½″ thick 85% Magnesia blocks. Apply such blocks directly to the metal of the ducts, wiring or otherwise holding them securely in place, and finish with Asbestos Cement and wire netting as provided in the specifications for Breechings.

BOILER DRUMS, TANKS, TRAPS, RECEIVERS, ETC.

Cover the exposed surfaces of boiler drums, tanks, traps, receivers, etc., to the same thickness and with the same type of materials specified for pipes 12″ and larger of corresponding temperature. Wire each layer securely in place, filling all cracks or openings with the corresponding grade of cement, and finish either with a hard finish cement troweled smooth or with canvas jacket of proper weight tightly stretched and smoothly pasted down.

TABLE No. 2

Heat Losses From Bare Iron Surfaces

	Temperature Difference °F. Between Hot Surface and Surrounding Air								
Pipe Size Inches	100°	200°	300°	400°	500°	600°	700°	800°	900°
½	59.4	141.2	253.4	402.1	595.1	832.9	1,116.	1,447.	1,826.
¾	70.7	168.8	303.6	486.2	721.8	1,015.	1,365.	1,773.	2,242.
1	86.0	206.4	371.5	597.2	887.5	1,249.	1,681.	2,188.	2,771.
1¼	106.6	255.6	462.0	744.7	1,107.	1,561.	2,104.	2,742.	3,477.
1½	120.0	288.8	522.9	842.6	1,252.	1,769.	2,391.	3,119.	3,958.
2	146.2	354.5	643.8	1,035.	1,549.	2,179.	2,948.	3,851.	4,893.
2½	172.4	418.6	761.3	1,232.	1,849.	2,611.	3,536.	4,626.	5,882.
3	206.3	500.7	910.6	1,478.	2,223.	3,142.	4,275.	5,597.	7,122.
3½	232.4	563.3	1,027.	1,667.	2,513.	3,562.	4,852.	6,357.	8,094.
4	258.2	627.2	1,146.	1,863.	2,812.	3,990.	5,430.	7,121.	9,076.
4½	284.3	689.0	1,265.	2,054.	3,105.	4,417.	5,980.	7,891.	10,060.
5	313.5	761.2	1,400.	2,274.	3,434.	4,899.	6,654.	8,736.	11,140.
6	369.8	899.2	1,656.	2,701.	4,071.	5,802.	7,887.	10,360.	13,220.
7	422.0	1,028.	1,896.	3,096.	4,670.	6,660.	9,058.	11,900.	15,190.
8	472.8	1,158.	2,131.	3,493.	5,270.	7,505.	10,230.	13,450.	17,160.
9	525.2	1,288.	2,371.	3,888.	5,870.	8,347.	11,400.	14,990.	19,130.
10	583.1	1,433.	2,639.	4,331.	6,542.	9,306.	12,710.	16,710.	21,340.
12	685.5	1,685.	3,110.	5,096.	7,707.	11,000.	15,000.	19,740.	25,220.
14	747.2	1,832.	3,382.	5,553.	8,406.	12,000.	16,380.	21,570.	27,560.
16	849.4	2,075.	3,841.	6,309.	9,560.	13,660.	18,660.	24,570.	31,400.
18	952.8	2,330.	4,316.	7,076.	10,731.	15,340.	20,970.	27,620.	35,320.
Flat	192.0	470.0	870.0	1,424.	2,160.	3,090.	4,228.	5,560.	7,119.
	100°	200°	300°	400°	500°	600°	700°	800°	900°

TABLE No. 2—Heat Losses from Horizontal Bare Iron Surfaces in B.T.U. per Lineal Foot of Pipe and per Square Foot of Flat or Large Radius Surfaces, per Hour.

TABLE No. 3

Heat Insulation Specifications

For Temperatures from 550°F. to 700°F.

Inner Layer Carey Hi-Temp No. 12, Outer Layer Carey 85% Magnesia

			Pipe Temperature 600° F.				Pipe Temperature 700° F.			
Pipe Size nches	Inner Layer Thick-ness Inches	Outer Layer Thick-ness Inches	Temp. °F. at Inner Mag-nesia Surface	Canvas Temp. °F. with Air at 70° F.	B. T. U. Loss per Lineal Foot per Hour Covered Pipe	B. T. U. Loss per Lineal Foot per Hour Bare Pipe	Temp. °F. at Inner Mag-nesia Surface	Canvas Temp. °F. with Air at 70°F.	B. T. U. Loss per Lineal Foot per Hour Covered Pipe	B. T. U. Loss per Lineal Foot per Hour Bare Pipe
½.....	1½	None	...	119	94.4	832.9	...	127	114.2	1,116.
¾.....	1½	None	...	122	105.9	1,015.	...	130	127.8	1,365.
1.......	1½	None	...	125	119.7	1,249.	...	133	144.5	1,681.
1¼.....	1½	None	...	128	137.3	1,561.	...	137	167.0	2,104.
1½.....	1½	None	...	130	149.4	1,769.	...	139	180.3	2,391.
2.......	1	1½	368	107	118.0	2,179.	416	114	143.5	2,948.
2½.....	1	1½	370	109	132.1	2,611.	425	117	160.8	3,536.
3.......	1	1½	380	115	151.0	3,142.	434	119	181.0	4,275.
3½.....	1¼	1½	356	109	151.7	3,562.	405	117	188.0	4,852.
4.......	1½	1½	339	109	164.0	3,990.	390	116	199.6	5,430.
4½.....	1¼	1½	347	108	166.9	4,417.	398	115	204.0	5,980.
5.......	1½	1½	344	110	184.3	4,899.	407	118	227.0	6,654.
6.......	1½	1½	348	112	209.3	5,802.	400	120	254.0	7,887.
7.......	1½	1½	353	113	231.0	6,660.	405	121	281.0	9,058.
8.......	1½	1½	356	115	254.0	7,505.	409	123	305.0	10,230.
9.......	1½	2	386	110	244.0	8,347.	446	117	297.0	11,400.
10......	1½	2	389	111	265.5	9,306.	449	118	322.0	12,710.
12......	1½	2	394	112	301.0	11,000.	454	120	370.0	15,000.
14......	1½	2	396	113	326.0	12,000.	456	121	400.5	16,380.
16......	1½	2	399	115	362.0	13,660.	461	123	441.0	18,660.
18......	1½	2	402	116	399.0	15,340.	464	124	486.0	20,970.
Flat....	1½	2	421	123	70.5	3,090.	487	132	86.2	4,228.

For temperatures between 550°F. and 700°F. reasonably accurate values can be obtained by interpolating the tables given above.

TABLE No. 4

Heat Insulation Specifications

For Temperatures from 700°F. to 800°F.

Inner Layer Carey Hi-Temp No. 12, Outer Layer Carey 85% Magnesia

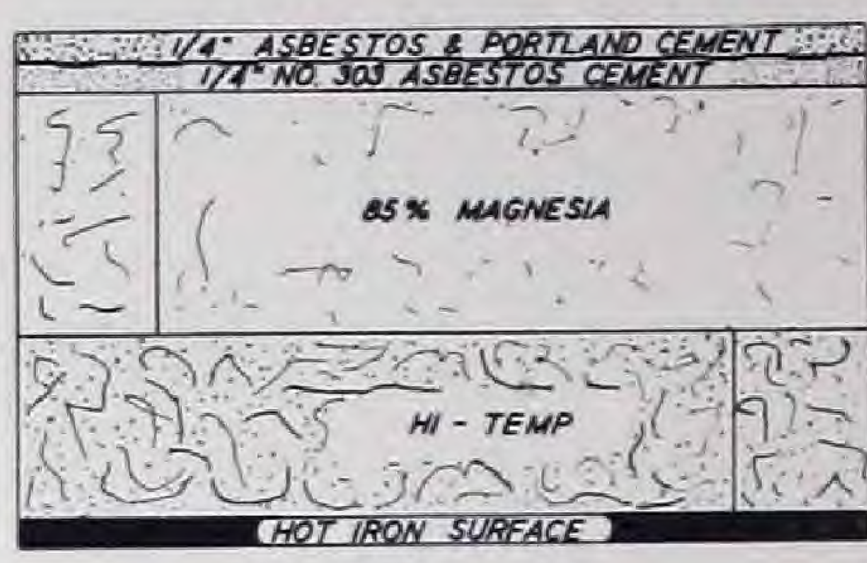
			Pipe Temperature 700° F.				Pipe Temperature 800° F.			
Pipe Size Inches	Inner Layer Thick-ness Inches	Outer Layer Thick-ness Inches	Temp. °F. at Inner Mag-nesia Surface	Canvas Temp. °F. with Air at 70° F.	B. T. U. Loss per Lineal Foot per Hour Covered Pipe	B. T. U. Loss per Lineal Foot per Hour Bare Pipe	Temp. °F. at Inner Mag-nesia Surface	Canvas Temp. °F. with Air at 70° F.	B. T. U. Loss per Lineal Foot per Hour Covered Pipe	B. T. U. Loss per Lineal Foot per Hour Bare Pipe
½	2	None	...	114	101.2	1,116.	...	121	119.5	1,447.
¾	2	None	...	117	113.0	1,365.	...	123	132.5	1,773.
1	2	None	...	120	126.2	1,681.	...	127	148.6	2,188.
1¼	2	None	...	123	144.0	2,104.	...	130	168.5	2,742.
1½	2	None	...	125	156.4	2,391.	...	133	182.7	3,119.
2	1	2	444	107	130.0	2,948.	502	113	154.4	3,851.
2½	1	2	455	109	145.0	3,536.	515	115	171.5	4,626.
3	1	2	463	111	163.0	4,275.	528	118	193.0	5,597.
3½	1¼	2	436	110	169.0	4,852.	494	116	200.5	6,357.
4	1½	2	417	109	176.0	5,430.	470	115	208.5	7,121.
4½	1¼	2	421	110	188.5	5,980.	475	116	223.2	7,891.
5	1½	2	430	112	207.5	6,654.	480	118	244.0	8,736.
6	1½	2	432	113	227.0	7,887.	490	120	270.0	10,360.
7	1½	2	437	114	251.0	9,058.	496	121	296.8	11,900.
8	1½	2	442	116	274.5	10,230.	500	123	326.0	13,450.
9	1½	2½	470	112	270.0	11,400.	533	118	320.0	14,990.
10	1½	2½	474	113	292.0	12,710.	538	120	347.0	16,710.
12	1½	2½	479	114	334.0	15,000.	543	121	397.0	19,740.
14	1½	2½	482	115	356.0	16,380.	546	122	423.0	21,570.
16	1½	2½	485	117	396.0	18,660.	550	124	472.0	24,570.
18	1½	2½	489	118	438.0	20,970.	555	125	521.0	27,620.
Flat	1½	2½	514	126	75.8	4,228.	584	134	90.3	5,560.

For temperatures between 700°F. and 800°F. reasonably accurate values can be obtained by interpolating the tables given above.

HEAT INSULATION FOR TEMPERATURES 500 ° F. TO 1200 ° F.

Table No. 5

Carey Hi-Temp No. 12 and 85% Magnesia—Heat Insulation Specifications for Stills, Tanks, Ovens and Similar Large Surfaces



Temp. difference °F. between hot surface and surrounding air	Heat Insulation				B. T. U. Loss per sq. ft. per hour		Approx. Temp. °F at inner surface of 85% Magnesia Insulation	Approx. Temp. °F. at outer asbestos cement surface	% Efficiency
	Inner Layer		Outer Layer						
	Kind	Thickness	Kind	Thickness	From Bare Surface	Through Insulation			
100	85% Magnesia	2″	....	....	192	17.8	....	85.5	90.7
150	85% Magnesia	2″	....	....	316.5	27.8	....	93.0	91.1
200	85% Magnesia	2″	....	....	470.0	37.8	....	100.5	92.0
250	85% Magnesia	2″	....	....	652.5	47.8	....	108.0	92.6
250	85% Magnesia	2½″	....	....	652.5	39.2	....	102.0	93.9
300	85% Magnesia	2½″	....	....	870.0	48.3	....	108.2	94.4
350	85% Magnesia	2½″	....	....	1127	57.4	....	114.5	94.9
350	85% Magnesia	3″	....	....	1127	48.7	....	108.7	95.7
400	85% Magnesia	3″	....	....	1424	56.9	....	114.0	96.0
450	85% Magnesia	3″	....	....	1767	65.2	....	119.3	96.3
450	Hi-Temp No. 12	1½″	85% Mag'sia	2″	1767	58.6	370	115.2	96.7
500	Hi-Temp No. 12	1½″	85% Mag'sia	2″	2160	66.2	403	119.5	96.9
550	Hi-Temp No. 12	1½″	85% Mag'sia	2″	2601	73.8	436	123.8	97.1
550	Hi-Temp No. 12	1½″	85% Mag'sia	2¼″	2601	68.8	448	121.9	97.3
600	Hi-Temp No. 12	1½″	85% Mag'sia	2¼″	3090	76.3	482	126.1	97.5
650	Hi-Temp No. 12	1½″	85% Mag'sia	2¼″	3633	83.8	516	130.3	97.7
700	Hi-Temp No. 12	1½″	85% Mag'sia	2¼″	4228	91.3	550	134.5	97.9
700	Hi-Temp No. 12	2″	85% Mag'sia	2″	4228	86.6	489	131.9	98.0
750	Hi-Temp No. 12	2″	85% Mag'sia	2″	4867	94.0	519	135.8	98.1
800	Hi-Temp No. 12	2″	85% Mag'sia	2″	5560	101.4	549	139.6	98.2
850	Hi-Temp No. 12	2″	85% Mag'sia	2″	6324	108.9	578	143.5	98.3

APPLICATION—Securely wire each layer of blocks so that at least two wires pass over each 36-inch long block. Butt all edges tightly and fill all cracks or openings between blocks with Hi-Temp No. 12 cement. (Do not permit use of any other kind.) Over second layer of blocks apply a rough coat, ¼″ thick, of No. 303 asbestos cement, followed by hexagonal wire mesh tightly stretched and firmly fastened, and finish with a ¼″ thick coat of a mixture, by weight of one part Portland cement and three parts No. 303 asbestos cement troweled to a smooth surface. For equipment within buildings finish with six ounce duck smoothly pasted on and painted as desired. For equipment exposed to the weather, finish with two coats of fibrous asphalt enamel (Carey Fibre Coating).

HEAT INSULATION FOR TEMPERATURES 500° F. TO 1200° F.

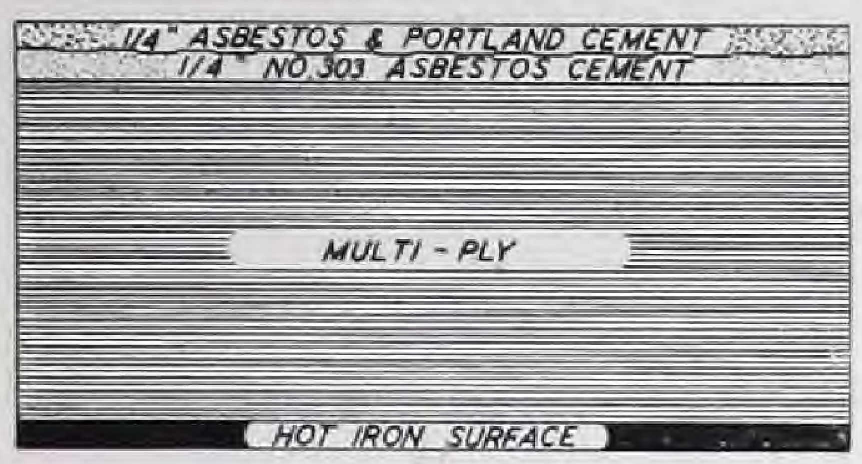
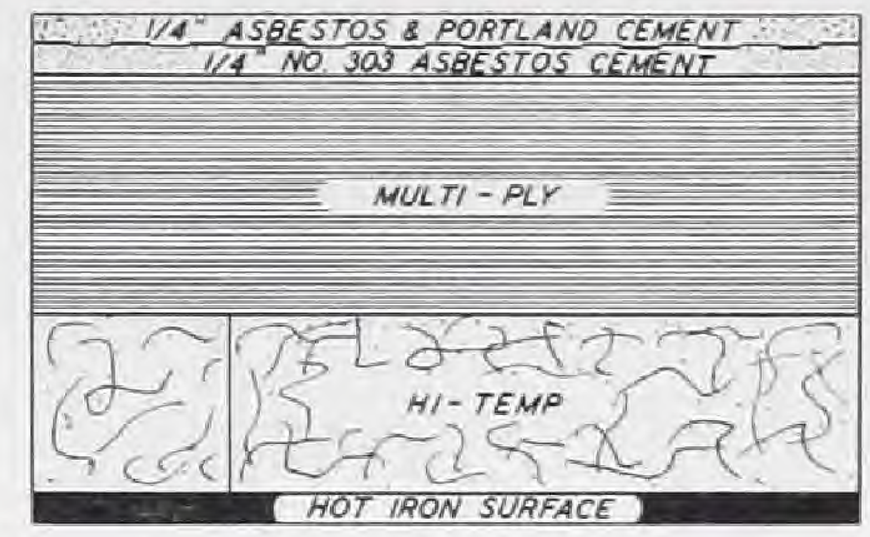


Table No. 6

Carey Hi-Temp No. 12 and Multi-Ply — Heat Insulation Specifications for Stills, Tanks, Ovens and Similar Large Surfaces



Temp. difference °F. between hot surface and surrounding air	Heat Insulation				B. T. U. Loss per sq. ft. per hour		Approx. Temp. °F. at inner surface of Multi-Ply Insulation	Approx. Temp. °F. at outer asbestos cement surface	% Efficiency
	Inner Layer		Outer Layer						
	Kind	Thickness	Kind	Thickness	From Bare Surface	Through Insulation			
100	Multi-Ply	2"	....	....	192	15.4	....	83.5	92.0
150	Multi-Ply	2"	....	....	316.5	24.1	....	90.6	92.4
200	Multi-Ply	2"	....	....	470.0	33.8	....	98.0	92.8
250	Multi-Ply	2"	....	....	652.5	44.0	....	105.4	93.2
250	Multi-Ply	2½"	....	....	652.5	36.2	....	99.8	94.4
300	Multi-Ply	2½"	....	....	870.0	45.6	....	106.5	94.8
350	Multi-Ply	2½"	....	....	1127	55.0	....	112.8	95.1
350	Hi-Temp No. 12	1½"	Multi-Ply	1½"	1127	48.7	292	108.7	95.7
400	Hi-Temp No. 12	1½"	Multi-Ply	1½"	1424	57.1	322	114.1	96.0
450	Hi-Temp No. 12	1½"	Multi-Ply	1½"	1767	65.5	352	119.5	96.3
450	Hi-Temp No. 12	1½"	Multi-Ply	2"	1767	56.0	376	113.5	96.8
500	Hi-Temp No. 12	1½"	Multi-Ply	2"	2160	63.3	410	118.0	97.0
550	Hi-Temp No. 12	1½"	Multi-Ply	2"	2601	70.6	444	122.6	97.2
550	Hi-Temp No. 12	1¾"	Multi-Ply	2"	2601	68.0	422	121.0	97.3
600	Hi-Temp No. 12	1¾"	Multi-Ply	2"	3090	75.5	453	125.3	97.5
650	Hi-Temp No. 12	1¾"	Multi-Ply	2"	3633	83.0	484	129.7	97.7
700	Hi-Temp No. 12	1¾"	Multi-Ply	2"	4228	90.5	514	133.9	97.9
700	Hi-Temp No. 12	2½"	Multi-Ply	1½"	4228	85.6	418	131.2	98.0
750	Hi-Temp No. 12	2½"	Multi-Ply	1½"	4867	92.7	440	135.2	98.1
800	Hi-Temp No. 12	2½"	Multi-Ply	1½"	5560	100.0	463	139.2	98.2
850	Hi-Temp No. 12	2½"	Multi-Ply	1½"	6324	108.6	488	143.4	98.2

APPLICATION—Securely wire each layer of blocks and sheets so that at least two wires pass over each 36-inch long block and over each sheet. Butt all edges tightly and fill all cracks or openings between blocks or sheets with Hi-Temp No. 12 cement. (Do not permit use of any other kind.) Over second layer of sheets apply a rough coat, ¼-inch thick, of No. 303 asbestos cement, followed by hexagonal wire mesh tightly stretched and firmly fastened, and finish with a ¼-inch thick coat of a mixture, by weight, of one part Portland cement and three parts No. 303 asbestos cement troweled to a smooth surface. For equipment within buildings finish with six ounce duck smoothly pasted on and painted as desired. For equipment exposed to the weather, finish with two coats of fibrous asphalt enamel (Carey Fibre Coating).

HEAT INSULATION FOR TEMPERATURES 500° F. TO 1200° F.

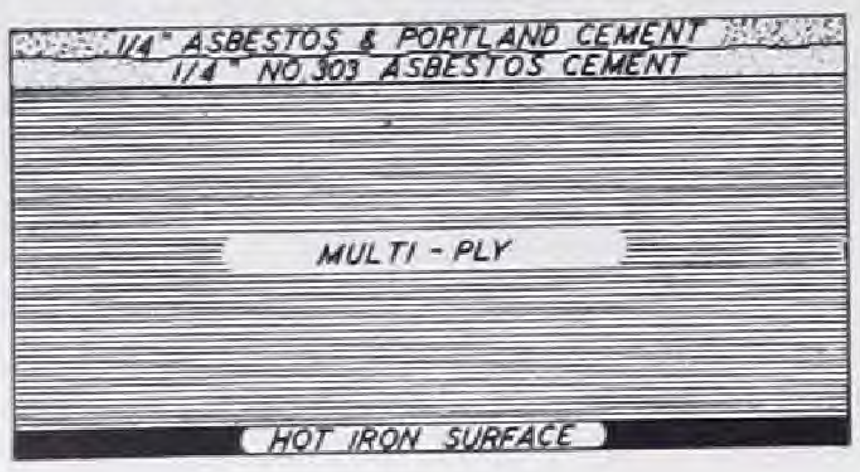
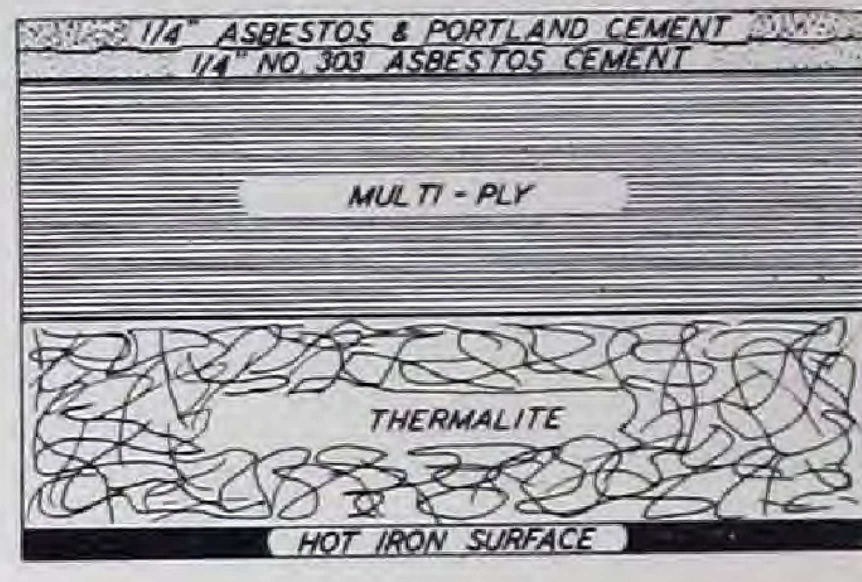


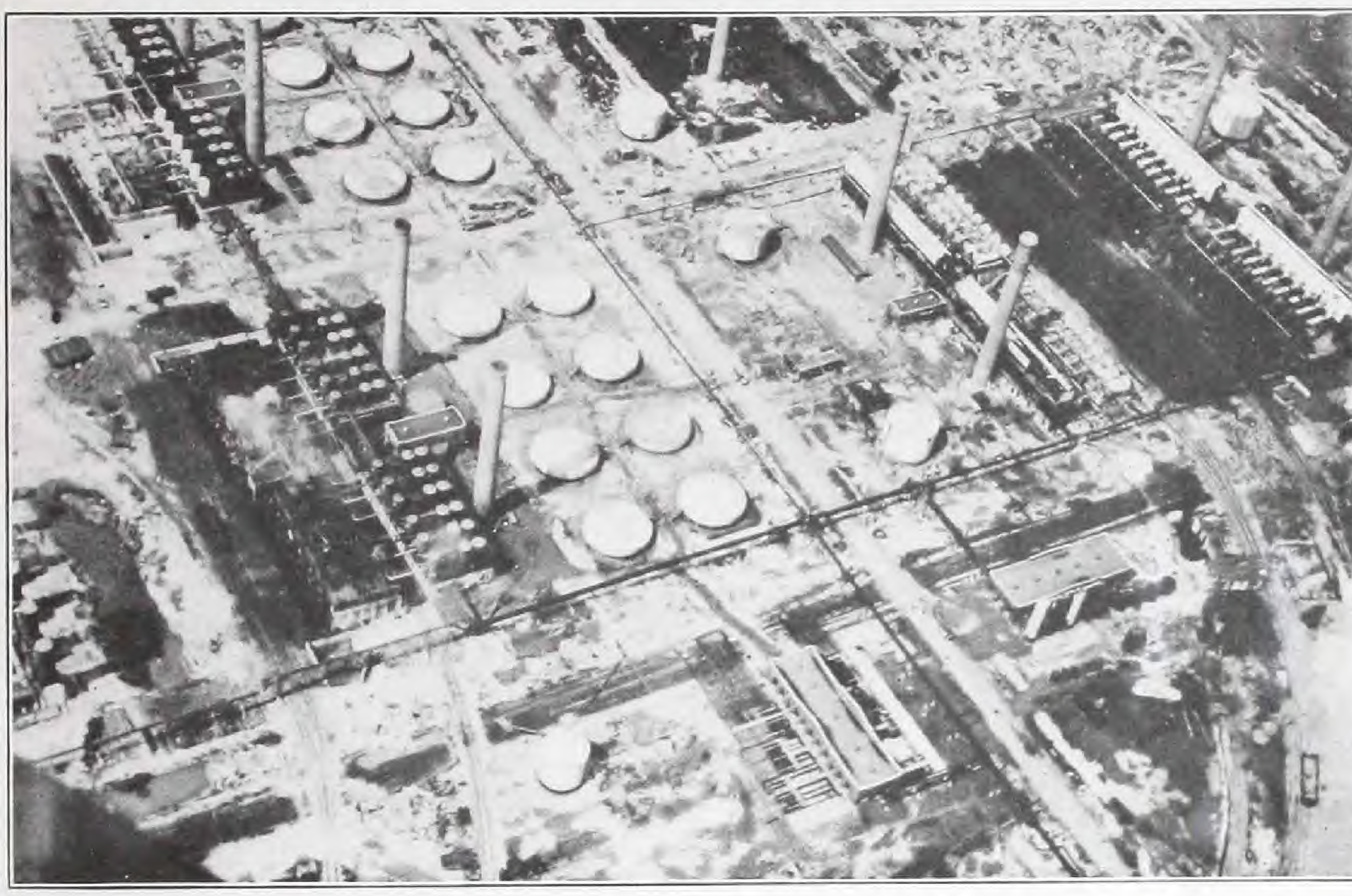
Table No. 7

Carey Thermalite and Multi-Ply—Heat Insulation Specifications for Stills, Tanks, Ovens, and Similar Large Surfaces



Temp. difference °F. between hot surface and surrounding air	Heat Insulation				B. T. U. Loss per sq. ft. per hour		Approx. Temp. °F. at inner surface of Multi-Ply Insulation	Approx. Temp. °F. at outer asbestos cement surface	% Efficiency
	Inner Layer		Outer Layer						
	Kind	Thickness	Kind	Thickness	From Bare Surface	Through Insulation			
100	Multi-Ply	2"	....	....	192	15.4	....	83.5	92.0
150	Multi-Ply	2"	....	....	316.5	24.1	....	90.6	92.4
200	Multi-Ply	2"	....	....	470.0	33.8	....	98.0	92.8
250	Multi-Ply	2"	....	....	652.5	44.0	....	105.4	93.2
250	Multi-Ply	2½"	....	....	652.5	36.2	....	99.8	94.4
300	Multi-Ply	2½"	....	....	870.0	45.6	....	106.5	94.8
350	Multi-Ply	2½"	....	....	1127	55.0	....	112.8	95.1
350	Thermalite	1½"	Multi-Ply	1½"	1127	52.8	306.5	111.3	95.3
400	Thermalite	1½"	Multi-Ply	1½"	1424	62.0	340	117.3	95.6
450	Thermalite	1½"	Multi-Ply	1½"	1767	71.5	373.2	123.2	96.0
450	Thermalite	1½"	Multi-Ply	2"	1767	60.6	396.0	116.6	96.6
500	Thermalite	1½"	Multi-Ply	2"	2160	69.3	431.8	121.8	96.8
550	Thermalite	1½"	Multi-Ply	2"	2601	78.0	467.6	127.0	97.0
550	Thermalite	1¾"	Multi-Ply	2"	2601	74.3	450.3	124.7	97.1
600	Thermalite	1¾"	Multi-Ply	2"	3090	83.2	484.0	129.9	97.2
650	Thermalite	1¾"	Multi-Ply	2"	3633	92.2	518.0	134.9	97.5
650	Thermalite	2¼"	Multi-Ply	1¾"	3633	86.8	471	132.2	97.6
700	Thermalite	2¼"	Multi-Ply	1¾"	4228	96.7	499	137.3	97.7
750	Thermalite	2¼"	Multi-Ply	1¾"	4867	106.6	527	142.4	97.9
750	Thermalite	2½"	Multi-Ply	1½"	4867	107.6	488	143.0	97.7
800	Thermalite	2½"	Multi-Ply	1½"	5560	117.2	514	147.5	97.9
850	Thermalite	2½"	Multi-Ply	1½"	6324	126.8	540	152.0	98.0

APPLICATION—Securely wire each layer of sheets so that at least two wires pass over each 36-inch long sheet. Butt all edges tightly and fill all cracks or openings between sheets with Hi-Temp No. 12 cement. (Do not permit use of any other kind.) Over second layer of sheets apply a rough coat, ¼" thick, of No. 303 asbestos cement, followed by hexagonal wire mesh tightly stretched and firmly fastened, and finish with a ¼" thick coat of a mixture, by weight, of one part Portland cement and three parts No. 303 asbestos cement troweled to a smooth surface. For equipment within buildings finish with six ounce duck smoothly pasted on and painted as desired. For equipment exposed to the weather, finish with two coats of fibrous asphalt enamel (Carey Fibre Coating).



Standard Oil Company, Toledo, Ohio. Carey Heat Insulation extensively used. Temperatures up to 1000° F. and even higher are now employed in the oil refining industry. Carey Hi-Temp No. 12 and Carey Thermalite are particularly adapted to use in this field, not only because of their high insulating value, but also because of their mechanical strength. They have found extensive use by such representative firms as the Standard Oil Companies of New Jersey, Ohio, and Louisiana, Roxana Petroleum Co., Humble Oil and Refining Co., Gulf Refining Co., Pan American Petroleum Co., etc.

HEAT INSULATION FOR TEMPERATURES 500° F. TO 1200° F.

Time Required to Repay Cost of Insulation and Savings Per Year

Pipe Temperature °F		500					600				
Fuel Cost—per million B. T. U.		$0.15	$0.20	$0.25	$0.30	$0.35	$0.15	$0.20	$0.25	$0.30	$0.35
2 in. Pipe	Material	2 in. th. Mg.					1 in. th. H-T., 1½ in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	8.50	6.39	5.10	4.24	3.63	7.7	5.7	4.6	3.8	3.3
	Saving per yr.	$1.28	$1.75	$2.22	$2.70	$3.17	$1.93	$2.63	$3.34	$4.03	$4.74
Cost of covering on pipe, "List" less 20%	*Months Required*	6.80	5.10	4.08	3.47	2.90	6.1	4.6	3.7	3.1	2.9
	Saving per yr.	$1.31	$1.78	$2.25	$2.73	$3.20	$1.99	$2.69	$3.40	$4.09	$4.80
4 in. Pipe	Material	D. S. Mg.					1 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	6.5	4.8	3.9	3.2	2.8	7.1	5.3	4.2	3.7	3.1
	Saving per yr.	$2.42	$3.29	$4.15	$5.02	$5.89	$3.21	$4.91	$6.31	$7.51	$8.81
Cost of covering on pipe, "List" less 20%	*Months Required*	5.2	3.9	3.1	2.6	2.2	5.7	4.2	3.4	2.8	2.4
	Saving per yr.	$2.47	$3.34	$4.20	$5.07	$5.94	$3.67	$4.97	$6.37	$7.57	$8.87
6 in. Pipe	Material	3 in. th. Mg.					1 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	8.5	6.3	5.1	4.2	3.5	5.9	4.4	3.5	2.9	2.5
	Saving per yr.	$3.48	$4.76	$6.05	$7.32	$8.60	$5.34	$7.24	$9.14	$11.04	$12.94
Cost of covering on pipe, "List" less 20%	*Months Required*	6.6	5.1	4.0	3.4	2.9	4.7	3.5	2.8	2.4	2.0
	Saving per yr.	$3.55	$4.83	$6.12	$7.39	$8.69	$5.41	$7.31	$9.21	$11.11	$12.01
8 in. Pipe	Material	3 in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	7.6	5.7	4.6	3.8	3.3	6.3	4.7	3.8	3.1	2.7
	Saving per yr.	$4.55	$6.21	$7.86	$9.52	$11.17	$6.94	$9.42	$11.90	$14.37	$16.86
Cost of covering on pipe, "List" less 20%	*Months Required*	6.1	4.6	3.7	3.8	2.6	5.0	3.8	3.0	2.5	2.2
	Saving per yr.	$4.63	$6.29	$7.94	$9.60	$11.25	$7.03	$9.51	$11.99	$14.46	$16.95
10 in. Pipe	Material	3 in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	7.1	5.4	4.2	3.5	3.0	6.0	4.6	3.6	3.0	2.6
	Saving per yr.	$5.73	$7.79	$9.85	$11.93	$13.99	$8.65	$11.72	$14.81	$17.90	$21.00
Cost of covering on pipe, "List" less 20%	*Months Required*	5.6	4.2	3.4	2.8	2.4	4.8	3.6	2.9	2.4	2.1
	Saving per yr.	$5.82	$7.88	$9.94	$12.02	$14.08	$8.77	$11.84	$14.93	$18.02	$21.12
12 in. Pipe	Material	3½ in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	7.8	5.9	4.7	3.9	3.4	5.5	4.1	3.3	2.7	2.4
	Saving per yr.	$6.71	$9.15	$11.59	$14.06	$15.49	$10.28	$13.93	$17.56	$21.25	$24.85
Cost of covering on pipe, "List" less 20%	*Months Required*	6.3	4.7	3.8	3.1	2.7	4.4	3.3	2.6	2.2	1.9
	Saving per yr.	$6.84	$9.28	$11.72	$14.19	$15.62	$10.41	$14.06	$17.69	$21.38	$24.93
14 in. Pipe	Material	3½ in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	8.2	6.1	4.9	4.1	3.5	5.4	4.1	3.2	2.7	2.3
	Saving per yr.	$7.29	$9.97	$12.64	$15.29	$17.99	$11.58	$15.68	$19.78	$23.88	$27.98
Cost of covering on pipe, "List" less 20%	*Months Required*	6.5	4.9	3.9	3.3	2.8	4.3	3.2	2.6	2.2	1.9
	Saving per yr.	$7.43	$10.11	$12.78	$15.43	$18.13	$11.72	$15.82	$19.92	$24.02	$27.12
16 in. Pipe	Material	3½ in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	8.8	6.6	5.3	4.4	3.8	5.4	4.1	3.3	2.7	2.3
	Saving per yr.	$7.52	$10.30	$13.10	$15.85	$19.60	$12.75	$17.28	$21.80	$26.30	$30.84
Cost of covering on pipe, "List" less 20%	*Months Required*	7.0	5.3	4.2	3.5	3.0	4.4	3.3	2.6	2.2	1.9
	Saving per yr.	$7.69	$10.47	$13.27	$16.02	$19.77	$12.92	$17.44	$21.96	$26.46	$31.00
18 in. Pipe	Material	3½ in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	7.8	5.8	4.7	3.9	3.3	5.3	4.0	3.2	2.6	2.3
	Saving per yr.	$9.34	$12.76	$16.16	$19.56	$22.96	$14.39	$19.49	$24.57	$29.65	$34.73
Cost of covering on pipe, "List" less 20%	*Months Required*	6.2	4.7	3.7	3.1	2.7	4.2	3.2	2.5	2.1	1.8
	Saving per yr.	$9.51	$12.93	$16.32	$19.72	$23.12	$14.56	$19.66	$24.74	$29.82	$34.90
Flat Surface	Material	4 in. th. Mg.					1½ in. th. H-T., 2½ in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	7.0	5.2	4.2	3.5	3.0	4.7	3.5	2.8	2.3	2.0
	Saving per yr.	$1.91	$2.60	$3.28	$3.98	$4.66	$2.92	$3.95	$4.98	$6.00	$7.03
Cost of covering on pipe, "List" less 20%	*Months Required*	5.6	4.2	3.3	2.8	2.4	3.7	2.8	2.2	1.9	1.6
	Saving per yr.	$1.95	$2.64	$3.33	$4.02	$4.70	$2.96	$3.99	$5.02	$6.04	$6.07

Saving is given in terms of dollars per lineal foot per year.
Cost of covering includes labor of application, and is given in terms of "List" price per lineal foot—see page 21.
Total cost of high pressure coverings applied on pipes is usually very close to printed "List" prices.
H-T is Carey Hi-Temp; Mg. is Carey 85% Magnesia.

HEAT INSULATION FOR TEMPERATURES 500° F. TO 1200° F.

Time Required to Repay Cost of Installation and Savings Per Year

Pipe Temperature F		700					800				
Fuel Cost per million B. T. U		$0.15	$0.20	$0.25	$0.30	$0.35	$0.15	$0.20	$0.25	$0.30	$0.35
2 in. Pipe	Material	1 in. th. H-T., 1½ in. th. Mg.					1 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	5.5	4.1	3.3	2.7	2.3	5.1	3.8	3.1	2.6	2.2
	Saving per yr.	$2.77	$3.75	$4.73	$5.71	$6.69	$3.78	$5.13	$6.47	$7.79	$9.13
Cost of covering on pipe, "List" less 20%	*Months Required*	4.4	3.3	2.6	2.2	1.9	4.1	3.1	2.5	2.1	1.8
	Saving per yr.	$2.83	$3.81	$4.79	$5.77	$6.75	$3.82	$5.17	$6.51	$7.83	$9.17
4 in. Pipe	Material	1 in. th. H-T., 2 in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	5.0	3.8	3.1	2.5	2.2	4.4	3.3	2.6	2.2	1.9
	Saving per yr.	$5.20	$7.04	$8.86	$10.70	$12.54	$7.13	$9.62	$12.11	$14.61	$17.11
Cost of covering on pipe, "List" less 20%	*Months Required*	4.0	3.0	2.4	2.0	1.7	3.5	2.6	2.1	1.8	1.5
	Saving per yr.	$5.26	$7.10	$8.92	$10.76	$12.60	$7.20	$9.69	$12.18	$14.68	$17.18
6 in. Pipe	Material	1 in. th. H-T., 2 in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	4.2	3.1	2.5	2.1	1.8	3.6	2.7	2.2	1.8	1.6
	Saving per yr.	$7.68	$10.34	$13.06	$15.71	$18.39	$10.47	$14.09	$17.72	$20.37	$24.97
Cost of covering on pipe, "List" less 20%	*Months Required*	3.3	2.5	2.0	1.7	1.4	2.9	2.2	1.7	1.5	1.2
	Saving per yr.	$7.75	$10.41	$13.13	$15.78	$18.46	$10.57	$14.19	$17.82	$20.47	$25.07
8 in. Pipe	Material	1½ in. th. H-T., 2 in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	4.5	3.3	2.7	2.2	1.9	3.0	2.2	1.8	1.5	1.3
	Saving per yr.	$10.00	$13.50	$17.00	$19.50	$24.00	$13.69	$18.44	$23.15	$27.89	$32.64
Cost of covering on pipe, "List" less 20%	*Months Required*	3.6	2.7	2.1	1.8	1.5	2.6	2.0	1.6	1.3	1.1
	Saving per yr.	$10.09	$13.59	$17.09	$19.59	$24.09	$13.79	$18.54	$23.25	$27.99	$32.74
10 in. Pipe	Material	1½ in. th. H-T., 2 in. th. Mg.					1½ in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	4.3	3.2	2.6	2.1	1.8	3.2	2.4	1.9	1.6	1.4
	Saving per yr.	$12.43	$17.78	$21.10	$25.50	$29.88	$17.05	$22.40	$28.80	$34.70	$40.50
Cost of covering on pipe, "List" less 20%	*Months Required*	3.4	2.6	2.1	1.7	1.5	2.5	1.9	1.5	1.3	1.1
	Saving per yr.	$12.55	$17.90	$21.22	$25.62	$29.92	$17.17	$23.02	$28.92	$34.82	$40.62
12 in. Pipe	Material	1½ in. th. H-T., 2 in. th. Mg.					2 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	3.9	2.9	2.3	1.9	1.7	3.5	2.6	2.1	1.8	1.5
	Saving per yr.	$14.80	$19.95	$25.10	$30.25	$35.40	$20.10	$27.10	$33.10	$40.10	$37.10
Cost of covering on pipe, "List" less 20%	*Months Required*	3.1	2.3	1.9	1.6	1.3	2.8	2.1	1.7	1.4	1.2
	Saving per yr.	$14.93	$20.08	$25.23	$30.38	$35.53	$20.26	$27.26	$33.26	$40.26	$47.26
14 in. Pipe	Material	1½ in. th. H-T., 2 in. th. Mg.					2 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	3.9	3.0	2.4	2.0	1.7	3.4	2.6	2.0	1.7	1.5
	Saving per yr.	$16.18	$21.78	$27.38	$33.08	$38.18	$22.04	$29.64	$37.44	$44.94	$52.64
Cost of covering on pipe, "List" less 20%	*Months Required*	3.1	2.4	1.9	1.6	1.3	2.8	2.1	1.7	1.4	1.2
	Saving per yr.	$16.32	$21.92	$27.52	$33.22	$38.82	$22.21	$29.81	$37.51	$45.11	$52.81
16 in. Pipe	Material	1½ in. th. H-T., 2 in. th. Mg.					2 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	3.8	2.9	2.3	1.9	1.6	3.4	2.5	2.0	1.7	1.4
	Saving per yr.	$18.40	$24.80	$31.20	$37.60	$44.00	$25.15	$33.85	$42.55	$51.15	$59.95
Cost of covering on pipe, "List" less 20%	*Months Required*	3.0	2.3	1.8	1.5	1.3	2.7	2.0	1.6	1.3	1.2
	Saving per yr.	$18.56	$24.96	$31.36	$37.76	$44.16	$25.34	$34.04	$42.74	$51.34	$60.04
18 in. Pipe	Material	1½ in. th. H-T., 2 in. th. Mg.					2 in. th. H-T., 2 in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	3.7	2.8	2.2	1.9	1.6	3.2	2.4	1.9	1.6	1.4
	Saving per yr.	$20.73	$27.93	$35.13	$41.38	$49.63	$28.33	$38.13	$47.98	$57.63	$67.48
Cost of covering on pipe, "List" less 20%	*Months Required*	3.0	2.2	1.8	1.5	1.3	2.6	1.9	1.5	1.3	1.1
	Saving per yr.	$20.90	$28.10	$35.30	$41.55	$49.80	$28.53	$38.33	$48.18	$57.83	$67.68
Flat Surface	Material	1½ in. th. H-T., 2½ in. th. Mg.					2 in. th. H-T., 2½ in. th. Mg.				
Cost of covering on pipe, "List" net	*Months Required*	3.3	2.5	2.0	1.7	1.4	2.7	2.0	1.6	1.4	1.2
	Saving per yr.	$4.19	$5.64	$7.09	$8.54	$9.99	$5.76	$7.73	$9.72	$11.72	$13.70
Cost of covering on pipe, "List" less 20%	*Months Required*	2.7	2.0	1.6	1.3	1.1	2.2	1.6	1.3	1.1	0.9
	Saving per yr.	$4.23	$5.68	$7.13	$8.58	$10.03	$5.80	$7.77	$9.76	$11.76	$13.74

Saving is given in terms of dollars per lineal foot per year.
Cost of covering includes labor of application and is given in terms of "List" price per lineal foot—see page 21. Total cost of high pressure coverings applied on pipes is usually very close to printed "List" prices.
H-T is Carey Hi-Temp; Mg. is Carey 85% Magnesia.

A FEW
CAREY HIGH TEMPERATURE INSTALLATIONS

American Steel & Wire Co.........New Haven, Conn.

Bethlehem Steel Co.........Bethlehem, Pa.
Binghampton Light, Heat & Power Co....Johnson City, N. Y.
Burrell Oil & Gasoline Co.........Pittsburgh, Pa.

Clayton Oil Refining Co.........Dallas, Texas
Columbia Power Co. (Ft. Miami Sta.)......Cincinnati, Ohio
Columbus Ry. Power & Light Co.,
(Picway Station) ....Columbus, Ohio.
Commonwealth Edison Co.
(Crawford Station) ....Chicago, Ill.
Connecticut Light & Power Co.........Devon, Conn.
Consumers Power Co.........Kalamazoo, Mich.
Consumers Power Co.........Saginaw, Mich.
Cosden Refining Co.........Tulsa, Okla.
Counties Gas & Electric Co.........Bridgeport, Pa.

Dallas Power & Light Co.........Dallas, Texas
Dow Chemical Co.........Midland, Mich.

Eagle Paper Co.........Joliet, Ill.

Fairmount Pumping Station.........Cleveland, Ohio
Florida Power & Light Co.........Sanford, Fla.
Ford Motor Co.........Detroit, Mich.
Fulton Iron Works.........St. Louis, Mo.

Galena Signal Oil Co.........Galena, Texas
Gulf Colorado & Santa Fe.........Temple, Texas
Gulf Refining Co.........Port Arthur, Texas

Hell Gate Station, United Electric
Light & Power Co.........New York, N. Y.

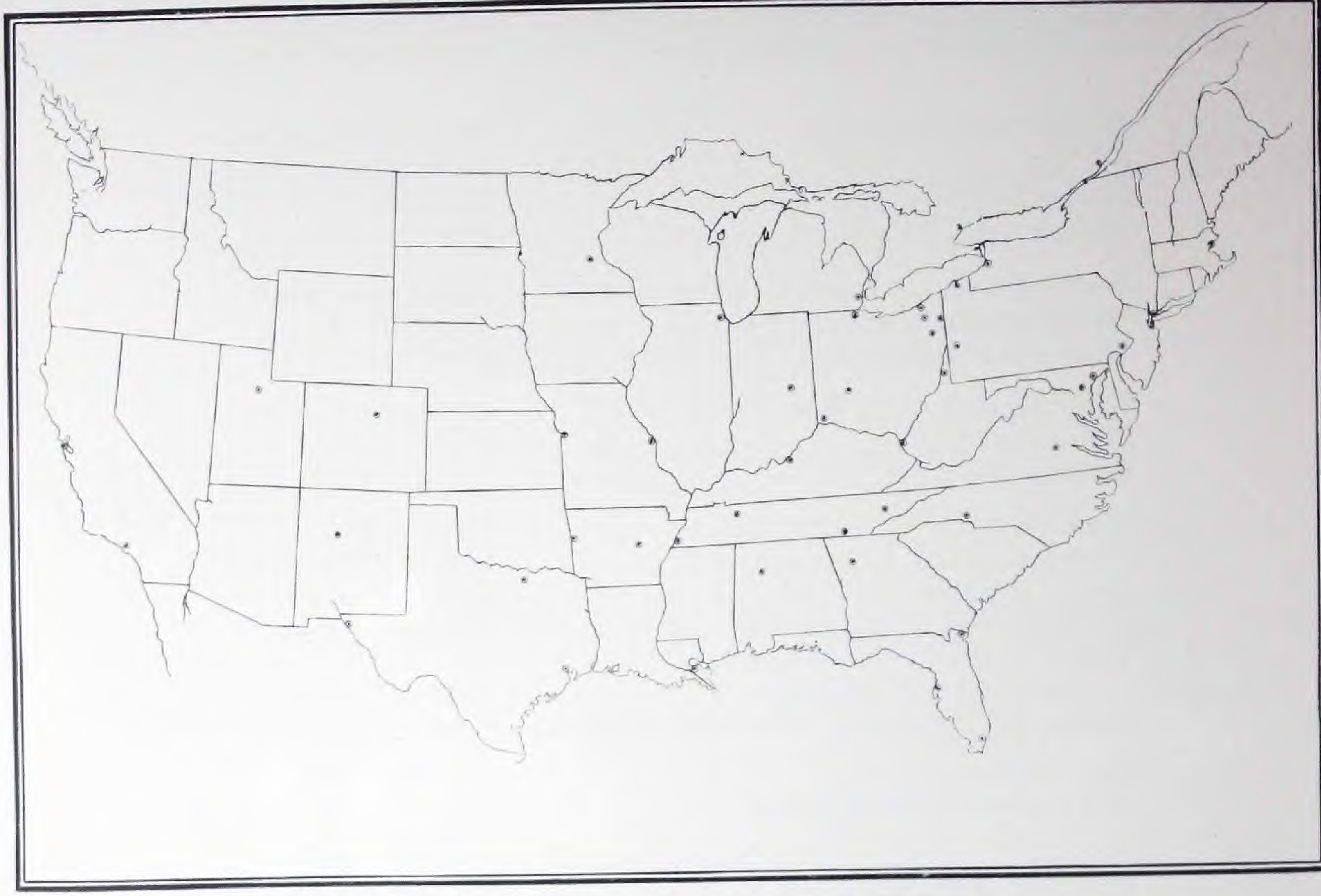
Illinois Power Co.........DeKalb, Ill.
Illinois Power & Light Co.........Venice, Ill.
Indiana Electric Corp.........Macksville, Ind.

Junior College ....Wichita Falls, Tex.

Knoxville Water Works.........Knoxville, Tenn.

Metropolitan Power Co.........Middletown, Pa.
Mexican Petroleum Co.........Baltimore, Md.
Midland Refining Co.........Eldorado, Kansas

Miller Petroleum Co.	Wichita Falls and Humboldt, Tex.
Misco Refiners, Inc.	Morando City, Tex.
Morgan & Wright	Detroit, Mich.
Nashville Ry. & Light Co. (1st Ave. Sta.)	Nashville, Tenn.
New Orleans Refining Co.	Good Hope, La.
New York Edison Co. (East River Sta.)	New York, N. Y.
Ohio Edison Co. (Mad River Plant)	Springfield, Ohio
Ohio Power Co.	Philo, Ohio
Omaha Refining Co.	Omaha, Nebr.
Pennsylvania Refining Co.	Karns, Pa.
Peoples Gas & Light Co.	Mason City, Iowa
Perry Electric Co.	Perry, Fla.
Philadelphia Electric Co.	Delaware Station
Public Lighting Commission (Morrell St. Station)	Detroit, Mich.
Public Service Corp. (Kearney Station)	Kearney, N. J.
Root Refineries, Inc.	Eldorado, Ark.
Roxana Petroleum Corp.	Wood River, Ill., & East Chicago, Ind.
Sapulpa Refining Co.	Sapulpa, Okla.
Sayles Biltmore Bleacheries	Biltmore, N. C.
Sinclair Refining Co.	East Chicago, Ill.
Skelley Oil Co.	Eldorado, Kansas
Southern Utilities Co.	Ft. Lauderdale, Fla.
Springfield Light, Heat & Power Co.	Springfield, Ohio
Standard Oil of Ohio	Toledo, Ohio
Standard Oil of Ohio	Cleveland, Ohio
Statler Hotel (breeching)	Boston, Mass.
The Improved Office Partition Co.	Elmhurst, L. I.
Texas Public Utilities Co.	Trinidad, Texas
Toledo Edison Co.	Toledo, Ohio
Transcontinental Oil Co.	Ft. Worth, Texas
Tubize Artificial Silk Co.	Hopewell, Va.
Union Electric Light & Power Co.	Cahokia Station, St. Louis
United Oil Co.	Farmington, N. M.
U. S. Oil & Refining Co.	Osage, Wyo.
Waverly Oil Works	Pittsburgh, Pa.
Youngstown Sheet & Tube Co.	Indian Harbor, Ind.



Note How Well the United States is Covered by Carey Distributing Centers

THE PHILIP CAREY COMPANY

General Offices - LOCKLAND, OHIO

FACTORIES - - - - - - *Lockland, Ohio, and Plymouth Meeting, Pa.*
ASBESTOS MINES - - - - - - - *East Broughton, Quebec, Canada*

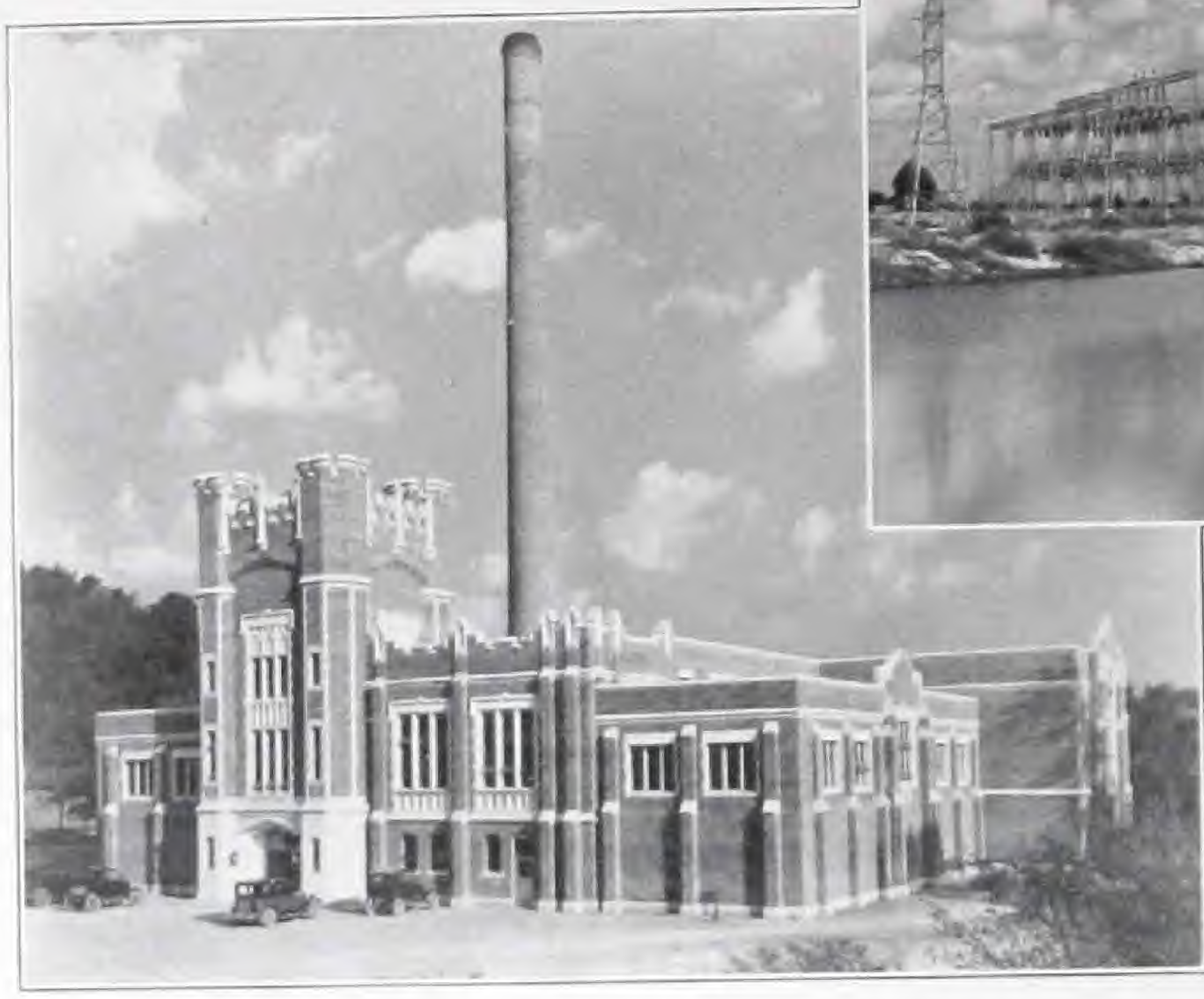
BRANCHES AND DISTRIBUTORS:

Distributor	*Street Address*	*City*
The Carey Company	East Thornton and High Sts.	Akron, Ohio
Sorenson Brick & Material Company	North First St. and Marble Ave.	Albuquerque, N. M.
The Philip Carey Company	411-412 Bona Allen Bldg. (P. O. Box 1227)	Atlanta, Ga.
The Philip Carey Company	1400 Blk. Moreland Ave. and W. M. Ry.	Baltimore, Md.
The Young & Vann Supply Co.	1725-31 First Ave.	Birmingham, Ala.
The Philip Carey Company	88 Cambridge St., Charlestown	Boston, Mass.
The Carey Company, Inc.	1172-1178 Niagara St.	Buffalo, N. Y.
The Carey Company	1704 11th St., S. W.	Canton, Ohio
The Charlotte Supply Company	Mint and First Sts. (P. O. Box 440)	Charlotte, N. C.

Distributor	*Street Address*	*City*
The Philip Carey Company	206-207 Builders' Bldg. (P. O. Box 203)	Charlotte, N. C.
James Supply Company	1106-12 Market St.	Chattanooga, Tenn.
Illinois Philip Carey Company	2100 Fullerton Ave.	Chicago, Ill.
R. E. Kramig & Co. (Insulation Dept.)	222-224 Webster St.	Cincinnati, Ohio
The Carey Company	5906-16 Euclid Avenue	Cleveland, Ohio
The Philip Carey Company	32 East Swan St.	Columbus, Ohio
Rogers Asbestos Co., Inc.	1103 Main St.	Dallas, Texas
The Philip Carey Company	Weakley St. and B. & O. Ry	Dayton, Ohio
Standard Sanitary Mfg. Company	1730 Blake St.	Denver, Colo.
The Carey Company	6197 Hamilton Ave., at Baltimore	Detroit, Mich.
The Carey Company	P. O. Box 39	Erie, Pa.
Momsen-Dunnegan-Ryan Co. (Insulation Dept.)	Overland, bet. Ochoa and Virginia St.	El Paso, Texas
Dyke Bros.	South Ninth and D St.	Ft. Smith, Ark.
Compania Commercial De Cuba (Roofing Dept.)	Manzanna de Gomez 269-270 (P. O. Box 325)	Havana, Cuba
Rogers Asbestos Co., Inc. (Insulation Dept.)	5 Live Oak Street	Houston, Texas
Banks-Miller Supply Co.	742 Third Avenue	Huntington, W. Va.
The Philip Carey Company	740 E. North St. (P. O. Box 1004)	Indianapolis, Ind.
The Cameron & Barkley Co.	605 E. Forsyth St.	Jacksonville, Fla.
Curry-Taylor Company	2008-2010 McGee St.	Kansas City, Mo.
A. G. Heins Company	100 Block Heins St.	Knoxville, Tenn.
Fischer Cement & Roofing Co.	1115-1121 E. Second St.	Little Rock, Ark.
Warren & Bailey Co.	214-216 East Third St.	Los Angeles, Cal.
Walter L. Lacy Company, Inc.	1032-1044 South Eighth St.	Louisville, Ky.
Fischer Lime & Cement Co.	263-295 Walnut St.	Memphis, Tenn.
The Cameron & Barkley Co.	127-129 N. W. Fifth St.	Miami, Fla.
W. S. Nott Company	2nd Ave. North and 3rd St.	Minneapolis, Minn.
The Philip Carey Company	201 North Third St.	Minneapolis, Minn.
Asbestos, Ltd.	1-3-3A McCord St.	Montreal, Que., Can.
T. L. Herbert & Sons	174 Third Ave. North	Nashville, Tenn.
J. J. Clark Company, Ltd.	Julia and Magnolia Sts. (P. O. Box 900)	New Orleans, La.
The Philip Carey Company	P. O. Box 1009	New Orleans, La.
Robert A. Keasbey Co. (Insul. Dept.)	Bank and West Sts.	New York, N. Y.
The Philip Carey Company	22nd and Westmoreland Sts.	Philadelphia, Pa.
The Philip Carey Company	Corliss Station	Pittsburgh, Pa.
The Philip Carey Company	1719 Summit Ave.	Richmond, Va.
The Philip Carey Company	4485-4487 Duncan Ave.	St. Louis, Mo.
The Galigher Co.	228 S. W. Temple St.	Salt Lake City, Utah
Jones Bros. Asbestos Supply Co., Inc.	500 Second St.	San Francisco, Cal.
The Cameron & Barkley Co.	South Franklin St. (P. O. Box 717)	Tampa, Fla.
The Carey Company	219 Cherry St.	Toledo, Ohio
Robt. T. Purves & Company	96-98 Vine Ave., West Toronto	Toronto 9, Ont., Can.
Asbestos Covering Company	916-918 D St., N. W.	Washington, D. C.
The Philip Carey Company	Chapline at 18th St.	Wheeling, W. Va.
The Carey Company	851 Wicks Ave.	Youngstown, Ohio

On the following pages are a few of the latest Hi-Temp installations

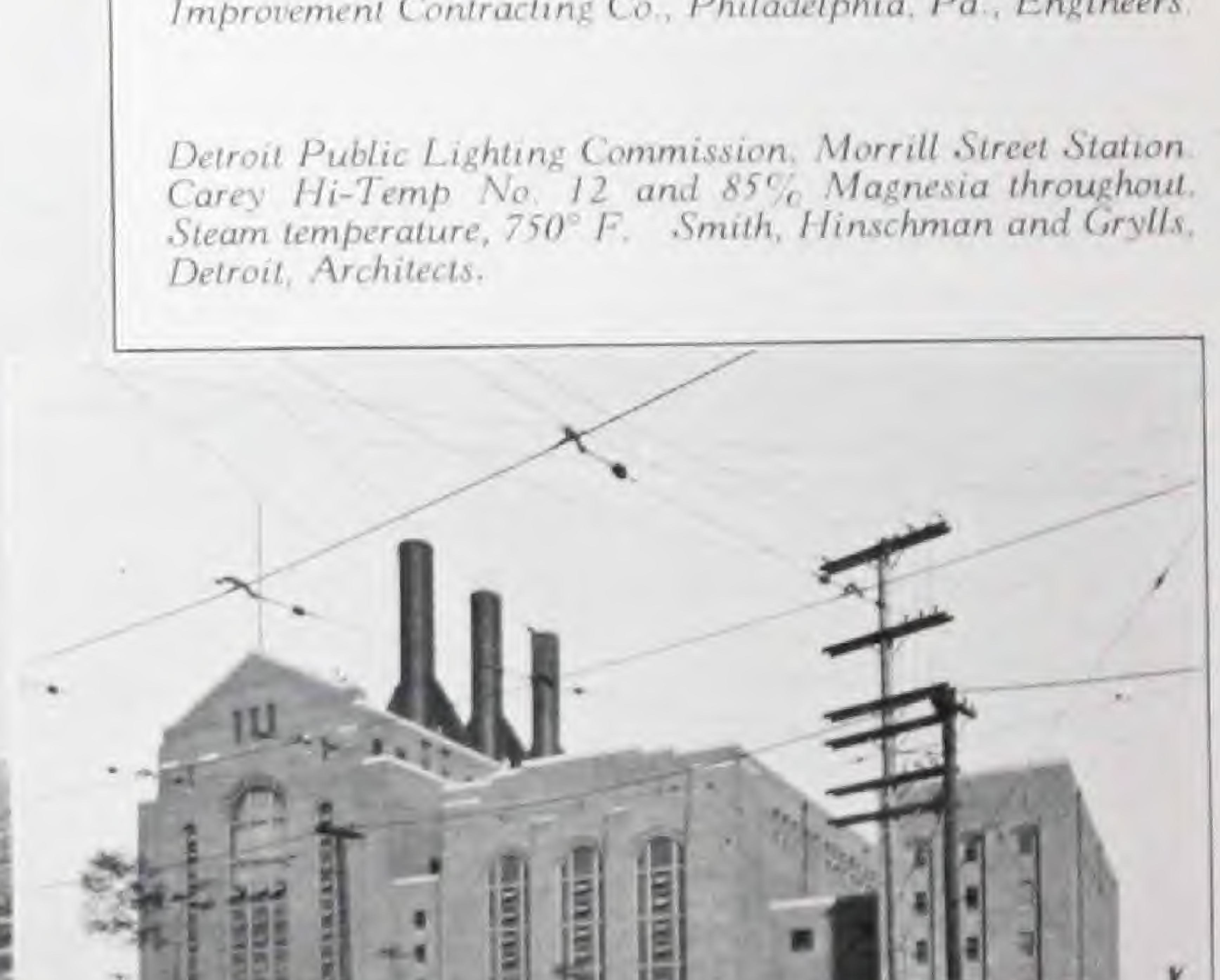
Exterior of the Trinidad Station of the Texas Public Utility Company, Trinidad, Texas. Designed by Electric Bond & Share Company, New York. Steam temperature up to 700° F. Insulations, etc., covered with Carey 1½ inch Hi-Temp and 2½ inch 85% Magnesia—4 inch total on all breeching insulated with metal lath, and large lines with 1½ inch thick Thermalite, finished with ½ inch Asbestos Cement.



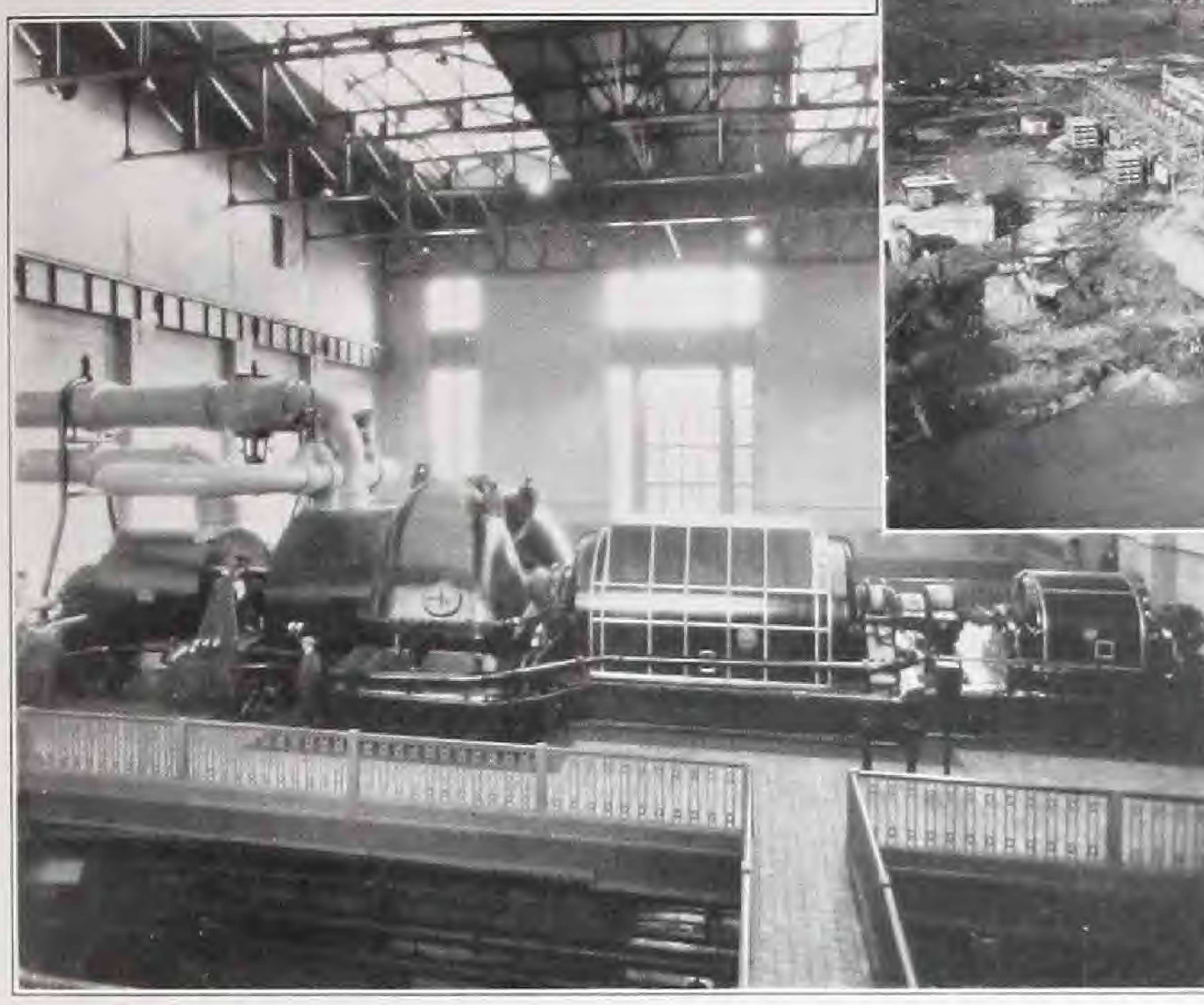
Knoxville Water Works, Knoxville, Tennessee. Carey Hi-Temp No. 12 and 85% Magnesia on super-heat lines. Alvord, Burdick and Howson, Chicago, Engineers.

Connecticut Power & Light Co., Devon, Conn. Insulation Carey Hi-Temp No. 12 and 85% Magnesia. United Gas Improvement Contracting Co., Philadelphia, Pa., Engineers.

Detroit Public Lighting Commission, Morrill Street Station. Carey Hi-Temp No. 12 and 85% Magnesia throughout. Steam temperature, 750° F. Smith, Hinschman and Grylls, Detroit, Architects.



Exterior view of Miami Fort Station, Miami Fort, Ohio—Columbia Power Company, insulating temperature up to 750° F. High temperature lines covered with Carey Hi-Temp No. 12, and Carey 85% Magnesia on superheat lines. Sargent & Lundy, Chicago, Engineers.



Interior view of Miami Fort Station, Columbia Power Company, Miami Fort, Ohio, showing Carey Hi-Temp and Magnesia on super-heat lines.

Ohio Edison Company, Springfield, Ohio. Mad River Plant. Carey Hi-Temp No. 12 and 85% Magnesia on super-heat lines. Commonwealth Power Corporation, Jackson, Michigan, Engineers.

East River Station of the New York Edison Company. All super-heated steam piping is insulated with Carey Hi-Temp No. 12 and Carey 85% Magnesia. Thomas E. Murray, Inc., New York City, Engineers.

Peoples Gas & Light Company, Mason City, Iowa. Carey Hi-Temp No. 12 and Carey 85% Magnesia on super-heated lines. The United Light & Power Engineering & Construction Company, Davenport, Iowa, Engineers.

Consumers Power Company, Kalamazoo, Michigan. Carey Hi-Temp No. 12 and 85% Magnesia on super-heat lines. Commonwealth Power Corporation, Jackson, Michigan, Engineers.

Binghamton Light, Heat & Power, Binghamton, New York. Carey Hi-Temp No. 12 and Carey 85% Magnesia used on this job. Constructed by Keasbey. W. F. Barstow—Management Association, Inc., Reading, Pa., Engineers.

Columbus Railway Power & Light Company, Piquay Station, Ohio. Carey Hi-Temp No. 12 and Carey 85% Magnesia on all super-heated lines. United Light & Power Engineering & Construction Company, Davenport, Iowa, Engineers.

Form 815. 15m-10-27.